A COMPLETE

PHYSICO-MEDICAL AND CHIRURGICAL

TREATISE

ON THE

HUMAN EYE AND EAR.

a

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PHYSICO-MEDICAL AND CHIRURGICAL

TREATISE

ON THE

HUMAN EYE.

THE SECOND EDITION,
CORRECTED AND CONSIDERABLY ENLARGED.

TO WHICH IS NOW ADDED,

A TREATISE ON THE HUMAN EAR.

AN ENTIRE NEW PUBLICATION.

PLAN TO STUDY PHYSIC AND SURGERY,
BOTH IN FRANCE AND GREAT BRITAIN.

THE WHOLE ILLUSTRATED WITH PLATES AND CASES.

Pierre de Gravers.

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PREFACE.

WHEN I first of all took it in my head to publish this *Physico-Medical and Chirurgical Treatise on the Human Eye*, I resolved to print not only my own discoveries, but also such as were made by others upon the same subject. I have been so very often disappointed on reading medical authors, and in imitating them on points of practice, that I have, through my own experience, deemed them not only insufficient and erroneous, but detrimental to humanity, discouraging to practitioners, and perplexing to students.

A WORK of this kind will always be of use to the medical world in general, as it contains nothing but what is true. I have endeavoured to

ſelect the moſt ſtriking caſes; to unite pleaſure with inſtruction. Moſt of the diſeaſes mentioned in the whole I have attended, or operated myſelf, after they had been given over by others; and the remarks which follow every ſubject are entirely my own. Anatomy and phyſiology have always been attended to particularly, to engage not only the attention of youth, but that of the medical and chirurgical practitioners. The curative methods are ſupplied with the remedies I employ in my practice: Men of the greateſt abilities have generally adopted them, to their credit, and the benefit of their patients. This branch of phyſic and ſurgery is difficult, but I am now in hopes to have it nearly explored to its very *minutiæ*.

As a ſcience advances in its progreſs, the ſteps become more and more difficult; the generality take diſguſt, and it is no longer cultivated but by a few obſtinate men, who take it up at heart, either by habit, or in hopes, well or ill grounded, to become famous in ſurmounting difficulties wherein ſome great men have failed. How uncertain ſhould not be our knowledge? Our organs are ſo weak,—our means ſo ſhort,—our ſtudies ſo interrupted,—our life ſo harraſſed,—and the objects of our enquiries ſo

vaſt!—

vaſt!— work without intermiſſion, Naturaliſts, Phyſicians, and Chymiſts of all ſorts; after centuries of united and continuous efforts, the ſecrets that ye ſhall have taken away from Nature, compared to her immenſe riches, will be but as a drop of water carried away from the ocean!

Between a number of agents that Nature employs, we know but few, and yet we know them imperfectly. Who knows if the others are not of a kind to eſcape for ever from our ſenſes, inſtruments, obſervations, and trials? Who will give a check to that inclination to analogy,—a manner to account and judge—ſo ſeducing—ſo convenient—and ſo deceitful? Hardly have we ſome facts, than we build ſyſtems on them, which carry away the multitude, and ſuſpend the reſearches of truth. The time employed to form an hypotheſis, and that to deſtroy it, are almoſt equally loſt.

It is by a multiplicity and variety of effects that we are ſometimes enabled to gueſs the cauſes of ſome intricate diſorders, and find out their remedies. No doubt, it is poſſible to an attentive and reflecting genius to forſee ſome events: But, ſo one lucky conjecture, how many errors! Since induſtrious anatomy and ſcrupulous

physiology have destroyed many of our chimeras, we have struck on a new shoal. We depend upon the opinions of a man *in place*, without considering whether he is right or wrong; and, by that implicit faith, we multiply mistakes without number.

MANY late writers, of avowed abilities, have not scrupled to advance, for facts, *things* which in reality are but anticipated, conjectural ideas, resulting from errors; this is not the fault of the inventors, but that of the imitators. It seems that in Great Britain, more particularly than in any other country, the body of medical and chirurgical practitioners is divided into three classes. What is the inferior but a mere body of quacks? Are not they consulted in the beginning of disorders? Are not they the monkeys of the first and second? Do not they make a branch of trade of the lives of their fellow-creatures? The empirics, who are generally despised, or envied on account of superior particular abilities, prove of more service to mankind, in several instances, than what we call the *regular bred* of this last class.

WHEN I published this WORK, it was with the view to take this branch of physic and surgery from improper

improper hands; and, in that intention, I have only imitated those learned physicians and surgeons who had published before me. All itinerant medical men are generally looked upon as ignorant or intruders; and, in that respect, whether learned or not, considered like so many of the third class. Monsieur Portal, a French physician, well known by his writings, courted foreign men, as he was conscious, that, in their practice, they are consulted mostly in chronical or incurable cases, through which they acquire extensive knowledge, and possess useful means, which became of use to his countrymen; but pride and antipathy to such practitioners entirely precludes an intercourse in this part of the world, on the ill grounded idea, that their theory and practice are *unexceptionable*.

THIS *Physico-Medical and Chirurgical Treatise on the Human Eye*, was published in the year 1780, with a variety of anatomical prints. The size of a Quarto made it rather too dear for medical students and others to purchase; on that account, I have thought proper to reduce it to the present Octavo, with a few etchings. I have added to it, *A Physiological Enquiry into various Subjects*, and a great many *Observations on difficult Cases*, which will prove of singular advantage to those

who

who cannot command a general practice; and these additions, I hope, will be received with more general satisfaction than the finest engravings.

The reader will find annexed to it, an entire new publication on the *Human Ear*, a subject never attempted before by itself, the materials of which I have been collecting these fifteen years past. Besides, I have subjoined to this, *A short Plan to Study Physic aud Surgery in less time than is usually employed*; having found by experience, that what I have been learning these twenty years, I might have done in three; and, in this particular, it will be of great service to young students.

It will appear in this work, that I have criticised Dr Alexander Monro on some anatomical and physiological points. Dr William Cullen's curative indications for the ophthalmia have likewise come under my notice, and also several surgeons of London and Edinburgh on practical operations. I would wish the reader to understand, that I took such liberty neither through envy nor malice, but merely as the cause of humanity is interrested in it. I am well aware that Dr Monro possesses extensive knowledge, as the other medical gentlemen, in their distinct capacities;

ties; but as ſome of them are public teachers, and of courſe ſooner believed than any other, I have thought theſe criticiſms juſt and abſolutely neceſſary. Some may indeed think that my expreſſions are harſh, and my conduct impolitical: What is that to me? I have but a few years to live; and if intereſted conſiderations had been conſulted in a Work which muſt ſurvive me, it would have defeated my intention of leaving behind—a Monument to the ſervice of Humanity.

ANATOMICAL EXPOSITION.

THOSE who were ſkilful in anatomy among the ancients, concluded, from the outward and inward make of an human body, that it is the work of a Being tranſcendently wiſe and powerful. As the world grew more enlightened in this art, their diſcoveries gave them freſh opportunities of admiring the conduct of Providence in the formation of an human body. There are, indeed, many parts of which the old anatomiſts did not know the certain uſe; but as they ſaw that moſt of thoſe which they examined were adapted with admirable art to their ſeveral functions, they did not queſtion but thoſe, whoſe uſes they could not determine, were contrived with the ſame wiſdom, for reſpective ends and purpoſes. Since the circulation of the blood has been found out, and many other diſcoveries have been made by our modern anatomiſts, we ſee new wonders in the human frame, and diſcern ſeveral important parts, which uſes the ancients knew nothing of. In ſhort, the body of a man is ſuch a ſubject as ſtands the utmoſt teſt of examination. Though it appears formed with the niceſt wiſdom, upon the moſt ſuperficial ſurvey of it, it ſtill mends upon the ſearch, and produces our ſurpriſe and amazement, in proportion as we pry into it. But to purſue this thought ſtill farther: Every living creature, conſidered in itſelf,

 has

has many very complicated parts, that are exact copies of ſome other parts which it poſſeſſes, and which are complicated in the ſame manner. One eye would have been ſufficient for the ſubſiſtence and preſervation of an animal; but, in order to better his condition, we ſee another placed with a mathematical exactneſs in the ſame moſt advantageous ſituation, and in every particular, of the ſame ſize and texture. If the anatomy of the human body in general preſents ſo many objects of difficulty to the underſtanding, how many more ſhall ſuch a delicate part as the globe of the eye, when conſidered and anatomiſed in all its particularities?

The Eye is ſituated in a cavity, which is called Orbit; it is made up of ſeven bones, *viz.* the os frontis, os ſphenoidale, os mallæ, os maxillary, os unguis, os ethmoides, and a little portion of the os palati. The os frontis forms the ſuperior part of the orbit, and a portion of the angles; the os ſphenoidale, the external poſterior and lateral inſide; the os mallæ, a portion of the external angles, and the inferior part of the orbit; the os maxillary, the remainder of the inferior inſide and portion of the internal angle; the os unguis, the anterior-lateral part on the ſame ſide; the os ethmoides, the lateral and poſterior inſide; laſtly, the portion of the os palati takes up the inferior and poſterior part.

The particular ſituation of the orbits repreſents two funnels, placed laterally at a ſmall diſtance from each other, and in ſuch a manner, that their apices are almoſt joined, their neareſt ſides almoſt parallel, and the other ſide turned obliquely backward. The bottom is perforated by the *foramen opticum*, through which paſſes a branch of the ſecond pair of the nerves, and the external ſide near this foramen, by two long, irregular, and orbitary fiſſures, one ſuperior, called ſphenoidalis, the other inferior, called ſpheno-maxillaris. Theſe fiſ-

ſures

ſures give paſſage to the nerves motores oculi, pathetici, ophthalmici, and to the portion of the *dura mater* which lines the orbitary cavity.

Under the arch of the orbit, near the temples, is a cavity, wherein is ſituated the *glandula lacrymalis;* and, towards the internal angle, a ſmall ring, where the pulley of the *obliquus major* is adherent. To the inferior part of the internal edge of the orbit, we find a foramen which extends from the middle of the ſpheno-maxillaris fiſſure to the inferior and external part of the orbit, and takes the name of *inferior orbitary foramen.* This foramen is partly covered with a thin plane of bone, and partly with the *dura mater.* A nerve, and ſome blood veſſels run through it. In the poſterior part, on the inſide of the internal angle, are the holes *orbiter interni,* through which paſs a filament of the nerve *ophthalmicus.* On the ſame ſide, but on the anterior part, you ſee the groove of the os unguis, and that of the maxillary. Theſe grooves form the bony lacrymal duct, whoſe ſuperior part is cut off; and near it, upon the os maxillary, where the *obliquus minor* is fixed, are many wrinkles.

The Eye is compoſed of ſeveral tunics or membranes, tranſparent bodies, and a limpid humor. Theſe tunics are ſet in one another at their adjacent edges, and cloſely connected in their whole extent by ſome nervous filaments, blood and lymphatic arteries which ſend them a juice fit for their nutrition; the blood veſſels are ſome ramifications of the carotid arteries; the nervous filaments are ſome ſubdiviſions of the motores oculi, pathetici, and ophthalmici.

The optic nerves ariſe backwards from the *nates & teſtes* towards the poſterior part of the *thalami nervorum opticorum.* They are parted, and very large in that place, and aſcend at firſt from bottom upwards, and

from within outwards, between the branches of the medulla oblongata, and the middle lobes of the brain; afterwards they deſcend a little in going from without within, and from behind forwards, until they come before the *infundibulum*, where they draw nearer and nearer, and at laſt unite together. The place of that union repreſents a ſquare more or leſs elongated, and whoſe dimenſions vary extremely in different ſubjects. They afterwards part anew and go from behind forward, from within outward, and from upwards downwards to the foramen opticum, through which they go out of the *cranium*. The optic nerve is ſituated about the internal poſterior and lateral part of the globe; it is the moſt conſiderable of the eye by far.

Twelve membranes make up the Eye, *viz.* the conjunctiva, albuginea, ſclerotica, cornea, the tunic of the aqueous-humor, iris, choroides, retina, cryſtalloida which is divided in cryſtalo-anterior and cryſtalo-poſterior, the capſule of the vitreous body or hialoida, and the cellulary tunic or arachnoida.

The conjunctiva takes up from the limb of the cornea to the internal edge of the tarſi of the eye-lids: it is of a ſoft texture, and mixt tranſparency; it is perforated by a great many ducts which have no communication with each other. They have their origin at the top of that membrane, and deſcend in parting from each other to the internal face of the ſuperior eye-lid, and open a little above the tarſi.

In the internal angle under the conjunctiva, is a reddiſh protuberance, framed by a conglomerated gland, called *caruncula lacrymalis;* it forms, together with the conjunctiva, a ſemilunar fold, termed *valvula lacrymalis*, where the tears gather, to paſs afterwards through the puncta and ducts lacrymalia, *ſaccus-lacrymalis*, and *ductus ad naſum*. This gland is compoſed of a great many ſmall,

ſmall, oblong, and whitiſh ones; they furniſh a ſebaceous humor, which is a part of the lacrymal fluid; and ſometimes after, this humor is changed into a matter vulgarly called the gum of the eyes, which foretells the atony of the filters of this glandulous body: when it is deſtroyed, an habitual flux of tears enſues, becauſe the puncta and ducts lacrymalia, though in their perfect ſtate, have not power enough to abſorb the exceſs of this fluid.

Under that part of the conjunctiva which lines the globe, is the albuginea, which forms the white of the eye; it is framed chiefly by the tendinous expanſion of the *muſculi recti*, and that of the obliquus major.

The ſclerotica takes up the lateral and poſterior parts of the globe; it is whitiſh and opaque in its whole ſubſtance; its texture is very cloſe, and its fibres directed every way; it is leſs hard and thick in its lateral parts than in the poſterior and anterior. This tunic is perforated before and behind; in the poſterior part, to let paſs the optic nerve; and in the anterior, to adapt as in a groove the limb of the cornea, as the glaſs of a watch. Beſides, it is perforated, at its poſterior part round the optic nerve, to let in the globe many arterial ramifications which ariſe from the arteria ophthalmica, and laterally by ſome other branches of the ſame artery, which take the name of ciliary arteries. Their number is between 25 and 30, and are ſpread in the internal and anterior parts of the eye; ſuch as the choroides, proceſſus ciliaries, iris, *&c.*

The *cornea* takes up the anterior part of the Eye, and is much thicker than the lateral and poſterior parts of the ſclerotica; it forms a portion of ſphere which makes it more convex than the other tunics contiguous to it. This tunic is made up of ſeveral pellicles ſituated on each other, and united by a texture of lymphatic arteries

teries and nervous filaments. Each *laminæ*, or pellicles, keeps its extent from the circumference to the center; and may easily be separated with a knife, or by maceration. Another way to know its structure is, when this tunic is cut in two portions, to introduce a small and round probe between these pellicles. A great many inorganic pores perforate this tunic, through which part of the aqueous humor runs, and produces a great portion of the tears.

Many anatomists have been of opinion, that the cornea was an expansion of the sclerotica; meanwhile these tunics are not continuous. You will be convinced of it, if you boil the eye of a calf for five or six hours; as soon as you take the eye out of the water, you'll have an opportunity of observing the cornea separated, if not entirely, at least a great part of it, from the tunic to which it was contiguous. If the cornea was a continuation of the sclerotica, could it be possible to separate them in such a manner?

In the concave part of the cornea only, there is a transparent and elastic tunic, which is adherent to it; it is termed the tunic of the aqueous humor; but improperly, as it does not surround or inclose the humor within itself. The extent of that tunic does not exceed the size of the cornea, tho' many recent authors speak to the contrary, at whose extremity it terminates; many facts, ascertained by a multiplicity of cases, particularly the cataract and staphyloma, leave no room to doubt upon the subject. When an ulcer with loss of substance has corroded the cornea throughout, without hurting the tunic of the aqueous humor, this tunic passes through and forms a tumor more or less considerable, called staphyloma. Several have been of opinion, that this tumor was only occasioned by the iris being out of its place; it is very uncommon to see both these tunics

form

form the same staphyloma. The irregularity of the pupil, together with the blackish or blueish color of the tumor, announces it produced by the iris: when it is occasioned by the tunic of the aqueous humor, then the tumor is water color or greyish, and the pupil keeps its natural shape.

Beyond the *cornea* you see a membrane variously colored, which is called iris; between both these membranes, is a space called the anterior chamber. From the center of the *cornea* to the hole of the iris, there is an interval of a line's distance. This chamber is full of a diaphane fluid, termed aqueous humor, which is a secretion of the vitreous and crystalline's. As soon as the aqueous humor is renewed, it runs through the excretory pores of the *cornea*, to lubrify the external parts of the globe, and at the same time help the refraction of the rays of light.

The Eye is called black, grey, blue, &c. from the color of the iris. The variety of this tumor is produced by more or less quantity of *nigrum pigmentum* or *meconium*, which penetrates its substance. The iris has, almost in its center, a round hole called pupil; it is dilated during sleep, as if the eye was exposed to a great darkness; its occlusion is the cause of blindness, but not without remedy. The pupil in the *fœtus*, is covered by a vascular membrane, extremely thin, contiguous to the iris, which disappears commonly about the seventh month, and sometimes later. It has been observed to exist after birth, and occasion blindness. The blood vessels, which ramificate over it, come from the anterior face of the iris, but not from the capsule of the crystalline lens, as has been advanced by Dr William Hunter, who did not admit a posterior chamber, which, however, is as evident as twice two make four. This vascular membrane is called *membrana pupillaris*, and has been disco-

vered

vered about 1720 by Dr Sandys, late phyſician and accoucher in London, who afterwards communicated the diſcovery to Dr William Hunter, who, on account of his inveterate hatred againſt Dr Sandys, did not chuſe to publiſh his name at full length.

The iris has circular and ſtraight fibres; the former are interwoven, and ſituated at the circumference of the pupil; the latter are placed in form of rays in its whole extent: their baſis is towards the limb of the *cornea*, and their extremity terminate at the circular fibres. When the radiated fibres begin to contract, they cauſe a dilation in the pupil; the circular fibres, on the contrary, being in action, the pupil has a leſs diameter. This dilation and contraction takes place alternately when the Eye is expoſed to a weak or ſtrong light.

Many ancient writers and ſome moderns have not ſcrupled to advance that a dilatation and contraction of the pupil take place when the Eye looks from diſtant to near objects, *& vice verſa*: That aſſertion is altogether groundleſs; for, if a perſon looks at any near or far object always expoſed to the ſame height, and the ſame degree of light, the pupil ſhall keep the ſame diameter. The error of thoſe writers may be accounted for in the following manner: The perſon looking at a near object placed low, the eye-lid and brow in that ſituation obſtructs part of the light, of courſe a dilatation muſt take place; on the contrary, if from that poſition the eye and lid are raiſed ſuddenly, the light becomes more glaring and ſenſible to the organ, then contraction takes place, conſequently the error comes from wrong and inapplicable obſervation.

Some anatomiſts agree, that the iris has ſeveral fibres to perform its motions; others deny their exiſtence, and have enquired into the cauſe which augments and diminiſhes

diminishes its diameter. Many observations confirm us in the opinion of the former.

You will easily discover, in the eye of a horse or ox, towards the posterior part of the iris, the circular and radiated fibres; and, at the same time, you will observe the texture of that tunic to be very different from that of the choroides: a strong proof they are contiguous, and not continuous. The following experiments are further proofs of it.

Cut the globe of an Eye into two hemispheres, about its middle part; convey a quill to the lateral and posterior part of the *plexus ciliaris*, and make some soft pressures upon that part, then you will have an opportunity of observing, that the *plexus ciliaris* separates from the choroides: When a large portion will be divided, take it with your fingers, at the least pulling it will give way from its adhesions, and part it from the remainder of the choroides; but you will see that the *plexus ciliaris* continues to be contiguous to it. These reasons are sufficient proofs that the plexus ciliaris is neither continuous to the choroides nor to the iris, but only contiguous to both.

The posterior face of the iris is covered with a black matter called *meconium*, or *nigrum pigmentum*. When an ulcer has eaten up the thickness of the *cornea*, and the tunic of the aqueous humor, then this fluid forces the iris through this hole, and a tumor more or less convex takes place. This disorder is called staphyloma, as aforesaid, which is divided into several sorts, according to its form and bulk.

The edge of the great circle of the iris has a folding protuberance like a wrist-band, which is called *plexus ciliaris*; it is united, in its whole circumference, to the limb of the *cornea*, by some whitish filaments. In this part only the iris is adherent, and its remainder

ſwims in the aqueous humor. The *plexus ciliaris* may alſo be looked upon as a muſcle appointed to ſuſtain forward the cryſtalline lens. The want of action in this muſcle is the cauſe of the preſbyopia.

The iris is lined by a tranſparent and elaſtic membrane, which has almoſt in its center a round hole, parallel to that tunic. Theſe diſtinct membranes have the ſame extent and adheſions: The tranſparent tunic of the iris is almoſt like that of the aqueous humor. The too great dilatation in the pupil, and its too great contraction, fortell a ſpaſm in the fibres of the iris, unmovable between theſe ſtates, the *gutta ſerena;* meanwhile, there are ſome particular caſes wherein the Eye is afflicted with perfect *gutta ſerena*, though the pupil changes its diameter; that is to ſay, it dilates and contracts itſelf, by a more or leſs quantity of light. The too great dilatation in the pupil is called mydriaſis.

Between the poſterior part of the iris and cryſtalloida, is a ſpace termed the poſterior chamber; it is filled up by the aqueous humor which paſſes through the pupil, in the anterior chamber. The poſterior is very narrow in proportion to the anterior: they are two reſervoirs to ſupply the tears. When a purulent matter is ſhed into the chambers of the eye, this diſorder is called hypopion.

The choroides is immediately under the *ſclerotica;* theſe membranes have the ſame extent: The choroides is made up of two lamina cloſely connected together; one which touches the *retina*, is called *membrana ruyſchiana;* the other, reticular. Theſe lamina are formed by a texture of fibres, nervous filaments, lymphatic and blood veſſels: from the latter flows a black matter or *meconium*, which is diffuſed through the whole extent of theſe laminæ, but in greater quantity, over the ruyſchiana. This kind of ink is not to be found in the anterior part of the choroides, which is oppoſite the pupil,

pil, in the eyes of many quatruped and other animals; it is ſometimes defective even in the eye of man. Though the choroides be composed of two lamina, it is however very delicate, and ſtronger in the poſterior parts of the globe than in the lateral. When the *meconium* or *nigrum pigmentum* paſſes through the veſſels of the vitreous body, or thoſe of the cryſtalline, then it tarniſhes their tranſparency, and is the cauſe of blindneſs. The ſwelling in the veſſels of the choroides, occaſions always internal inflammations, ſuppurations, &c.

The *retina* lines, and takes up the ſame extent as the choroides: both theſe membranes end at the plexus ciliaris, where they are cloſely connected. The *retina* is of a ſoft texture, and like a kind of paſte ſpread upon a fine reticular web: it is of a mixt tranſparancy after death, and like an oiled paper. The *retina*, in living animals, is very bright, eſpecially in the natural ſtate, and loſes of its tranſparancy, as well as the diaphanous bodies of the eye, after death.

The *retina* is a production or expanſion of the medullary ſubſtance of the optic nerve: in its texture, are very apparent blood-veſſels, whoſe diameters diminiſh in proportion as they go from the optic nerve: it is the immediate organ of ſight. This opinion is generally received, and is the only one which can be wiſely admitted. The paralyſis of the *retina* and optic nerve bring on the *gutta ſerena*.—Dr Alexander Monro, in his Nervous Syſtem, chap. xii. p. 37, ſays, that the pia mater is not laid aſide in the retina or within the cochlea, nor at the extremities of the nerves in general. It is, however, a fact, that the pia mater cannot follow the retina, becauſe this nervous expanſion ariſes from the center of the optic nerve, and not from the edge, conſequently the pia mater cannot accompany the retina, nor be ſupport-

ed by it. As to the cochlea it will be mentioned, in the treatise on the Ear.

The vitreous body is like a transparent jelly; it takes up from the posterior part of the globe to the plexus ciliaris. The elasticity of this body comes from its structure; it is made up of two tunics, and of a very limpid water, the very same kind as that of the aqueous humor. The external membrane, which is its general coat, is called the vitreous capsule or *hyaloida*; it is perforated by a great many holes, some to give passage to the vessels which go from the *retina* into the vitreous body, to furnish it with the necessary juice fit for its nutrition, and renew the fluid contained in its cellulary spaces; the others are pores through which transudes this humor.

The cells of the vitreous body are composed of the internal tunic, which is called cellulary or *arachnoida*; it is much thiner and more delicate than the *hyaloida*. The cells of the vitreous body are very small; they differ from each other in their form and size; the fluid contained in them passes from one cell into another, through some very little pores, to renew the aqueous humor.

In the anterior part of the vitreous body, is a cavity termed *fossula*, wherein the crystalline is lodged, exactly after the same manner as a diamond is set in a ring. This cavity keeps a conical form, as soon as the crystalline is out of it. The vitreous body, on account of its being less dense than the crystalline, proves the refraction upon both these transparent bodies very different from each other: for which reason, those who have undergone the operation of the cataract by extraction, cannot read easily without the help of a convex glass; meanwhile, some may do without it. The vitreous capsule or *hyaloida* is adherent to the *retina*, by a great

many

many lymphatic arteries, but much more about the circumference of the *plexus ciliaris.* You may ſee, at the circular edge of the *foſſula*, a coat full of radiated *ſulci*, which contain the *proceſſus ciliaris* of the *uvea.* The diameter or thickneſs of the vitreous body is commonly about three quarters of an inch.

The vitreous body is to keep the coats of the eye in a perfect ſtate of tenſion, to hold the cryſtalline lens, help the refraction of the rays of light, ſupply, by the convexity of its *foſſula*, the want of the cryſtalline lens when it is out of its place; laſtly, to ſupply as aforeſaid the aqueous humor.

The opacity of the vitreous body is known among the moderns under the name of *glaucoma;* its melting occaſions not only the atrophy of the globe of the eye, but the irreparable loſs of the organ.

The *proceſſus ciliaris* are many ſtraight fibres, whoſe baſis is adherent to the *plexus ciliaris*, and the remaining part of their extent, to the vitreous body; they are as full of the ſame *meconium* as the *plexus ciliaris* and choroides. Several have been of opinion, that they were a continuation of the plexus; for which reaſon they termed the whole *corona ciliaris;* meanwhile they are contiguous, and not continuous, becauſe they may be put aſunder very eaſily without tearing.

Extract the vitreous body out of an eye, then you will ſee the whole *proceſſus ciliaris* attached to it, conſequently their baſis is ſeparated from the plexus ciliaris. The uſe of the proceſſus ciliaris is to ſuſtain forth the cryſtalline, together with the plexus ciliaris. When theſe parts are paraliſed, the eye becomes preſbit, what commonly happens to old men; but the uſe of a magnifying glaſs, or remedies propoſed in ſuch a caſe, may be of great benefit: there are, however, ſome who have occaſion for neither.

The

The cryſtalline is not only lodged in the foſſula of the vitreous body, but likewiſe wrapt up in a capſule called cryſtalloida; it is made up of two ſpheroides and concave tunics adapted to one another about their edges. The portion which covers the foſſula, is termed cryſtalo-poſterior; the other, cryſtalo-anterior: The latter is leſs extenſive and thick than the former.

The poſterior part of the cryſtalloida is perforated by a great many blood veſſels, which come from the inſide of the vitreous body, and the long ciliary arteries to ſupply morgani's humor, and ſerve of nutrition to the cryſtaline lens. The cryſtalo-anterior is compoſed of ſeveral laminæ connected one upon another. They may be divided very eaſily in the eye of a horſe, after ſix days maceration in water. The cryſtalloida is adherent to the edge of the foſſula, by a great many veſſels. You may ſee in the whole circumference of the limb of the cryſtalo-anterior, a great quantity of ſmall grooves, wherein is ſet a little portion of the ſulci-ciliaris. Sometimes after the extraction of the cryſtaline lens, the cryſtaloida becomes opaque, what we call a ſecondary cataract. It may happen too, that both become opaque at the ſame time; but this is a very uncommon caſe.

The cryſtalline lens is a ſmall lenticular body, more convex in its poſterior part than in its anterior: anteriorly it is almoſt flat, and poſteriorly parabolic. Its tranſparency is analogous to the moſt diaphane cryſtal, but only in young men's eyes. At thirty years old, it begins to acquire a light yellow color, and, by degrees, increaſes till it be quite opaque. There are, however, a great many cauſes which may alter the tranſparency of the cryſtalline lens, and of courſe produce a cataract.

The cryſtalline lens is compoſed of a great many ſegments or curvi-lineal pellicles heaped one upon another, after

after the ſame manner as thoſe of an onion. When it is dried by the ſun or before the fire, you may ſeparate them, if you ſqueeze it betwixt your fingers.

Between the cryſtalline lens and its capſule, is to be found a ſpace full of viſcous and limpid humor, diſcovered by the famous MORGANI. This humor, called *morgani*, is ſupplied by a great number of blood veſſels, which penetrate through the cryſtalloida, and ſerves of nutrition to the cryſtalline; when they are obſtructed it becomes ſtagnant and afterwards whitiſh, an evident ſymptom of a begining cataract.

You may ſee under the depreſſion, obſervable in the arch of the orbit near the temples, a conglomerated gland of an oval, and a little flatted form, ſometimes divided into ſeveral lobes. Many different inequalities, cauſed by the irregular aſſembling of the ſmall glands which compoſe it, are moreover, to be ſeen: it is wrapt up in a capſule, from which a great many ducts proceed, and run down almoſt in the whole extent of the *tunica interna* or *conjunctiva* of the ſuperior eye-lid, and afterwards pierce it inwardly near the internal edge of the tarſus, from whence exſudes a part of the tears. The *glandula lacrymalis* may not only become ſchirrhous but voluminous, and to ſuch a degree, as to be able to ſqueeze the globe of the eye, and occaſion its ſuppuration.

The motions of the globe of the eye are ruled by ſix muſcles, *viz.* four recti, and two obliques: The third, fourth, fifth, and ſixth pairs of the nerves ſend them ſome nervous filaments.

The four *muſculi recti*, and the *obliquus major*, are fixed by their poſterior extremities at the bottom of the orbit, near the *foramen opticum;* they are made up of ſtraight fibres involved in a capſule, and their aponeuroſis end at the limb of the cornea, where they form the

the albuginea. The poſition of the four muſculi recti renders them almoſt of an equal diſtance.

The muſcle which is ſituated at the top of the globe, is called ſuperior, or *levator*; it moves the globe upward. The inferior, or *depreſſor*, is placed at the lower part of the eye; it brings the viſual pole downwards. The internal, or *adductor*, is in the internal angle; it carries the globe towards the noſe. The external, or *abductor*, is in the external angle; it turns the eye towards the temples. The ſucceſſive action of the four *muſculi recti* occaſions a circular motion, and their ſimultaneous action fixes the organ horizontally.

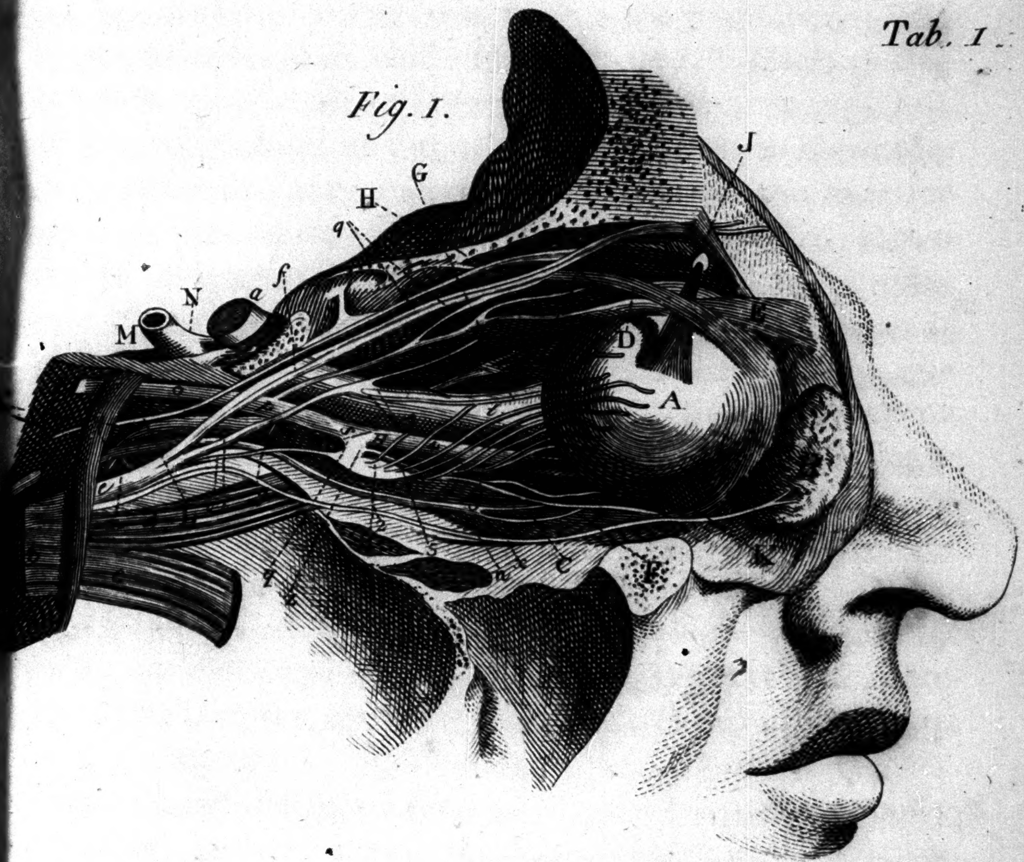
The *obliquus major* is likewiſe called *trochlearis*, becauſe it paſſes through a ſmall cartillaginous ring, as over a pulley, which is ſituated on the inſide of the internal angle, and joins the globe of the eye by its aponeuroſis.

The *obliquus minor* is ſituated obliquely at the lower ſide of the orbit, under the *rectus inferior*, which conſequently lies betwen this muſcle and the globe. It is fixed by one extremity a little tendinous to the root of the naſal apophyſis of the os maxillary, near the edge of the orbit, between the overture of the *ductus ad naſum*, and the inferior orbitary fiſſure. The fibres of this muſcle are ſtraight and involved within a ſheath.

From thence the muſcle paſſes obliquely, and a little tranſverſally backward, under the *rectus inferior*, and is fixed in the poſterior lateral part of the globe by a flat tendon, oppoſite and at a ſmall diſtance from the tendon of the *obliquus major*; ſo that theſe two muſcles do, in ſome manner, ſurround the outer poſterior part of the globe.

The uſe of the oblique muſcles is to move the globe towards the noſe, eſpecially when it is horizontal, and to render parallel the *axis* of the eyes. Every body knows,

Fig. I.



knows, that the action of a muſcle cannot be perform-ed, unleſs its antagoniſt yields to the effort of the other. The ſpaſmodic motions contract ſometimes the muſcles of the eyes to ſuch a degree, as to be able to break the parallel of their axis, which is the fore-runner of ſome dangerous diſorders, nay of the ſtrabiſm at the ſame time.

The interſtices of the muſcles of the eye are taken up by ſoft beds of fat, which keep the flexibility of the muſcular parts and their motions free. Theſe greaſy bodies are alſo to preſerve the globe from the hard-neſs of the inſides of the orbit, and ſtretch it forwards.

The eye-lids are to keep the organ from the exterior injuries, and water it uniformly with the tears, in or-der to preſerve the brightneſs of the *cornea*, and mode-rate the action of light, air, and rubbing; their exte-rior ſtructure is made up of the continuation of the *epi-dermis*, ſkin, *membrana adipoſa*, eye-brows, and *cilia*, or eye-laſhes.

The eye-brows are ſet upon the upper portion of the ſuperior eye-lid, and are deſigned by nature as an or-nament to the human ſpecies. The eye-laſhes, or *cilia*, when in a natural ſtate, form a ſingle row of hairs to each external edge of the eye-lids. When the *cilia* are bent towards the eye, this diſorder is called *phtoſis*.

The ſuperior eye-lid is larger, and its tarſus thicker than that of the inferior; the former has perpendicular motions, and the latter oblique ones. Both eye-lids have action and re-action, when they uncover the globe. The motions of the eye-lids are alſo termed winkings.

The internal ſtructure of the eye-lids is compoſed of three muſcles, *viz.* two orbicular, and the other called *levator palpebra ſuperioris*; of the *tarſi*, the *glandulæ ſe-baceæ meibomii*, their excretory ducts, thoſe of the *glan-*

dula lacrymalis, the puncta and ducts lacrymalia, and of a portion of the *conjunctiva*.

The superior eye-lid has two muscles, the one called *levator*, the other *superior orbicularis*. The levator is fixed at the bottom of the orbit, from thence it goes to the edge of the cavity: When it is arrived under the arch, it bends to adapt itself to the superior eye-lid; its fibres run forward, increasing gradually in breadth, and terminate by a very broad aponeurosis in the tarsus of the superior eye-lid. This muscle being in action, lifts up the eye-lid.

The *orbicularis* of the superior eye-lid is made up of curve-lines connected one upon another; their extent is from the internal angle to the external. This muscle is larger in the center of the eye-lid than in the angles, where it is fixed at a tendon in each angle. The action of this muscle is to bring down the superior eye-lid.

The inferior eye-lid has but one muscle, called *inferior orbicularis*, and less large than the superior: it has oblique motions, by which means it is impowered with action and re-action as the other. Every one of these muscles has a particular sheath, and their extent and structure are the same: the middle tendons are common to them all.

The *tarsi* are thin half circular cartilages forming the principal part of the edge of each eye-lid; they are united together at the angles, which is termed Commissures. The superior tarsus is thicker than the inferior, and their extremities or commissures more slender than in the center. Each tarsus is disposed in such a manner, that its interior edge is a kind of groove to let the tears run towards the internal angle.

The eye-lashes are produced by some bulbs, which are set over the whole extent of the external edge of the

the tarsus. When they take rise in the internal edge, this disorder is called *trichiasis*. The brushing which happens upon the globe tarnishes the *cornea*, and inflames the *conjunctiva*.

In the internal angle upon the end and edges of the *tarsi*, are two little holes, one at each eye-lid, called puncta lacrymalia; each has a spincter which contracts and dilates itself, and their ducts have a vermicular motion, which is repeated at each winking, what helps the passage of the tears into the *saccus lacrymalis*, and from thence through the *ductus ad nasum* into the nostril.

Jane Gilchrist, who was in the Edinburgh Infirmary about November 1786, has three puncta lacrymalia to her right Eye only, two inferiors, and one superior. The inferior puncta are very distinct, and distant from each other of half a line; they have each a distinct duct, which extends to the common duct. I passed two small probes at the same time, to convince me that there was no communication of the ducts until all three were ending at the common duct. She was troubled with a violent inflammation, but not on account of these puncta lacrymalia and ducts, as she never had bad Eyes till she came at the age of seventeen.

The lacrymal ducts are formed by a muscular membrane, whose fibres are straight, and those of their sphincters interwoven. These ducts join together a little before they communicate with the saccus lacrymalis, under the commissure of the internal angle, to form but one duct, which is adapted to the lacrymal sac, to pour out the tears into it.

The *saccus lacrymalis* is an oval, irregular, and a little flatted bag, or reservoir; it is made up of a spongious membrane, interwoven with fibres, blood vessels, and a great many small glands, through which flow an excretory humor more viscous than the tears: it is

 lodged

lodged in the groove of the os unguis, and the inferior part of the channel formed by the os maxillary and unguis.

The *saccus lacrymalis* has in its inferior part a duct, termed *ductus ad nasum*, which terminates the reservoir of the tears. This duct has its diameter larger in its superior part than in the inferior. The constant contraction of the sphincter forces the tears to stay in the lacrymal sac.

If you squeeze with your fingers the *saccus lacrymalis*, when this sphincter is obstructed, a purulent matter will discharge out of it: this malady is termed fistula lacrymalis. If this matter is too thick, it cannot get out through the puncta lacrymalia, then a great dilatation in the bag takes places. Sometimes this fluid corrodes the sac and its teguments, and causes a general inflammation. This last case is an evidence of a complete fistula lacrymalis.

Almost all the parts of the Eye receive their arteries from the *ophthalmica*; this artery is a branch of the internal carotid. It passes under the optic nerve, and when entered into the orbit, its divisions are various and irregular, as we do not find them alike in several subjects. The first ramifications are very small; some go to the globe of the Eye, the remotest parts of its muscles, and the *dura mater*. It produces also the lacrymal artery, the ophthalmic arteries, the central and visual arteries of the optic nerve, and the ciliary arteries; in short, many other arteries, which do not deserve a particular name, on account of their smallness and irregularity.

The veins of the eye have been a mystery or rock on which the most acurate and industrious anatomists have fairly wrecked. I have made several experiments to discover the number of the biggest, and their situation, and among the numerous and finest injections I have been

been able to operate, I remain firmly convinced that there is not one vein, that can be properly diſtinguiſhed as ſuch, except thoſe commonly called vorticoſæ of the choroides and iris, and their receptacles which join the vena ophthalmica. Scrupulous obſervation on different caſes has fairly indicated me to believe, that many arteries above mentioned have no veins, and that the blood does not return from them into the general circulation, but ſerves to ſupply the vitreous body, cryſtaline lens, aqueous humor, and the tear's which are not produced by the globe of the eye, beſides the nutrition of its coats. This idea being entirely new, will appear very ſtrange to opinionated anatomiſts, but not ſo to ſuch as are practitioners. The conjunctiva and cornea are often overun with varicous veſſels, that I have been obliged to deſtroy, in order to effect a cure; and what is moſt ſingular, theſe varicous veſſels grow amazingly faſt, and keep their ground as long as they are not deſtroyed. In inflammatory caſes, I have frequently ſeen the blood in the tranſparent cornea of the Eye, and in the iris, and profuſe bleeding unable to diſpel it; therefore, it is no wonder if anatomiſts have been at a loſs to deſcribe the veins, and their ſituations; but we ought to wonder why they have hazarded to qualify ſo many veſſels, as veins, whilſt they are in fact real blood and lymphatic arteries. See the phyſiological enquiry which follows the anatomical expoſition.

The optic nerve is not the only nerve which goes to the Eye; ſome branches come from the common *motores oculi*, the ciliary nerves, the ſuperior maxillary nerve, the *ophthalmici*, *pathetici*, and a branch of the hard portion of the auditive nerve.

ANATOMICAL AND PHYSIOLOGICAL ENQUIRY

Into the CIRCULATION *of the* BLOOD *through the* ARTERIA OPHTHALMICA, *and the* VENA OPHTHALMICA; *wherein is included, a ſhort* ACCOUNT *of the* BRAIN, *the* NERVOUS *and* MUSCULAR FIBRES, *the* SEAT *of the* SOUL, *and other* SUBJECTS *analogous to the* HUMAN EYE *and* EAR.

THE carotid artery, before its inſertion into the cranium, gives the ophthalmic artery, which accompanies the optic nerve through the foramen opticum; this laſt artery gives other ſmall branches which are ſpread in the orbit. Many of theſe branches have no correſponding veins, through which the blood can return in the principal veinous trunk, that go out of the orbit.

Several diſeaſes have long ago made me believe, that the blood thrown into the orbit, and the globe of the eye, through the ophthalmic artery and its ramifications, did not return from many of them to the vena ophthalmica. When I had injected through the carotid artery, the venæ vorticoſæ were filled; if I injected through the jugulary vein only, the venæ vorticoſæ were likewiſe filled, but the ramifications of the ophthalmic artery did not fill. It ſeems to me, that anatomiſts have too much depended upon Zinn, who has been at a vaſt deal of trouble upon the ſubject. I have followed all the branches of the ophthalmic artery, and I never

never was able to diſcover that they had correſponding veins, except five of the ciliary arteries, which join the venæ vorticoſæ of the choroides, and four ſmall long arteries which project on the face of the iris, to join ſome whirlings ſimilar to thoſe of the choroides. My enquiry was, what might be the reaſon why ſo many ſmall arteries did not bring the blood back in the general circulation? The reſult of many fine injections, ſupported by ſeveral caſes, have convinced me, that nature has deſigned them to ſupply the vitreous and aqueous humors, the tears through the ducts of the glandula lacrymalis, and thoſe of the conjunctiva. Some of the ſmalleſt branches are loſt in their courſe, ſuch as the viſual arteries below deſcribed, which terminate at the inſertion of the optic nerve; the ramifications of the arteria centralis of the optic nerve, which end with the retina, near the internal part of the proceſſus ciliaris; the varicous blood-veſſels of the conjunctiva, which are loſt on the ſurface of the cornea, or worn out by the frictions of the lids on the globe; and ſeveral ramifications which are loſt on and in the muſcles of the eye, and other parts of the orbit.

The nerves, according to Monſ. Sabatier, author of the beſt treatiſe on anatomy at preſent, are white chords ariſing from the brain, medulla oblongata and the vertebral, which go to every part of the body. Their colour is greyiſh and ſomewhat reddiſh, on account of a great number of blood veſſels which penetrate into them. The nerves are neither elaſtics nor irritables; their external coats are not equally thick, being extremely thin at different parts, and abſolutely wanting over thoſe which paſs through foramens, and protected or ſupported by planes of bones. This aſſertion evidently proved by diſſections, ſhows the error of Dr A. Monro, quoted in the anatomical deſcription of the eye. As to the other

ther deſcriptions and ideas which M. Sabatier ſeems to adopt with regard to the medullary ſubſtance of the brain and nerves, I beg leave to differ from him upon very good reaſons.

The nervous fibres are not hollow, therefore they cannot contain a ſpirituous liquid or fluid commonly called *animal ſpirit*, through which ſuppoſition he pretends, with Haller, Zinn, and others, to explain the principal functions, actions, and phenomenons of the nervous ſyſtem. My idea is, that the brain is made up of very ſoft but compact fibres, penetrated and ramificated by an infinite number of blood veſſels which ariſe from the heart: That the nerves are ſo likewiſe, but their fibres ſomewhat more ſolid; and that their nature is to receive and tranſmit their ſenſations to the brain, *the grand focus of ſenſe*, in the ſame manner as conductors tranſmit the electrical fluid; that when their veſſels are deprived of blood, or too full of it, they either diminiſh or augment in ſenſibility; and when obſtructed or ruptured, they produce pain. By this phyſiological ſyſtem, all ſymptoms of the nervous diſorders are rationally explained and underſtood. The following injections and diſſections will throw ſome more light upon the ſubject.

Hang a ſheep by the neck; cut it down before it is apparently dead; ſevere the head from the body, and put it into warm water; inject the carotid arteries with a warm injection made of white roſin finely powdered, and a ſufficient quantity of Pruſſian blue or carmine, likewiſe finely powdered, to give it a deep colour; pour a ſufficient quantity of ſpirit of wine, ſo as to render the injection middling ſoft when cold; warm it again, and inject when you ſuppoſe the blood entirely abſorbed, but inject while the head is in the warm water; and afterwards take it out, and put it in a cold place,

TAB. II.

Fig. 1.

place, before you diſſect the nerves. By repeated injections of that ſort, you will diſcover the inſertion of the *arteria centralis* of the optic nerve to be at about an inch from the poſterior part of the globe of the Eye, and its courſe into the middle, and two branches ariſing from it, which ramificate over the *retina*. You will alſo ſee, that ſeveral other ſmaller arteries have their inſertion into the optic nerve, for an inch long or more; and on cutting only the coats of the nerve longitudinally, and putting ſmall briſtles between the nerves and the coats, you will be able to ſee the biggeſt with the naked Eye. I have once counted nine in the ſpace of an inch; and I had every reaſon to ſuppoſe there were many more. This done, divide the nerve tranſverſally with a ſharp knife, at three lines from the globe, you will ſee a vaſt number of blood veſſels injected, which go longitudinally to the very inſertion of the optic nerve in the globe, where I believe they end; but theſe are more diſtinctly ſeen with the microſcope. I recollect very well, that, in the year 1781, when I was employed with Mr John Sheldon, profeſſor of Anatomy in London, in diſſections, and particularly the human Eye and animals, there was the part of an human optic nerve, wherein we could ſee four of the arteries above mentioned, and it was only prepared with a common red injection. I had put ſome briſtles between the nerve and the coats, and we obſerved, that after their paſſage through the coats, they ran along the optic nerve for a line long, and then inſerted diagonally in the ſubſtance of the nerve. I gave them the name of *viſual arteries*, and to thoſe of the portio mollis of the auditive nerves, which I diſcovered two years after, *haurial arteries*; thoſe in other nerves, and the ſubſtance of the brain, *ſenſual arteries*.

I imagine that the most subtile part of the blood, thrown into the substance of the brain by these blood vessels, does not return, but serves to vivify its substance, the quantity being duly calculated by nature for that purpose. Monsieur Sabatier says, that he has observed two central arteries in the optic nerve. I do not wonder at it; but, if he will take the trouble to enquire closer into the matter, he will easily find, that the pretended second central artery was one of the principal trunks of the visual arteries. The injection above described does not pass into the substance of the brain, on account of too many gross parts which its contains, and the small diameter of the blood vessels; but if Prussian blue be properly dissolved in spirit of wine, and immersed with some clear water, mixed with a little size, and injected through the principal arteries of the *dura mater*, with Anel's syringe, used for the lacrymal ducts, the injection of the sensual arteries will be seen with the microscope into the very substance of the brain.

I turned my thoughts to see further into the matter; and, after repeated tedious injections and dissections, I have likewise observed many blood vessels into the substance of the auditive nerve; but the trouble and expence which attend these experiments is such, that it is no wonder to me, if these observations have escaped us so long. My enquiries did not stop there: I have dissected many other nerves, to see if I could find a confirmation of the above observations, and the result of more easy dissections have evidently convinced me, that whenever these blood vessels end, a new insertion of arteries supplies, as it were, the absence of the above, and so on smaller and smaller, to the very end of each nerve, which I suppose, from analogy, is vivified by a very small one. But I must not omit to mention here, that I have been disappointed many times, on account of

rupture

rupture in the veſſels when the animal hung too long, and when I had puſhed the injections with too much or too little force, and, in diſſections, by ſpoiling the part.

From theſe experiments and obſervations, I think that the brain and nerves are vivified or nouriſhed by the blood, and not by an animal ſpirit different from it; nor are their hollow fibres in them, as Hovius pretends, and ſome authors of ſome anonymous publications in the Academical memoirs of Berlin, wherein a magnified print of the optic nerve is exhibited, and in the *Journal des Sçavans*. I fancy that theſe authors have taken the blood veſſels for hollow fibres. By theſe experiments, the ſtructure of the internal parts of the brain, and its vivification, which were not yet known, and which *Steno* and *Sabatier* deſpaired of ever being diſcovered, are at laſt come out. The vaſcularity of the pia mater, ſo well injected by Ruyſch and Albinus, together with its conſiderable extent and circumvolutions round the brain, between which it manifeſtly folds and refolds again and again, ſhould have indicated to theſe great men, that their injections through the carotid arteries could not penetrate into the ſenſual arteries, which are undoubtedly contiguous; and that thoſe ſeveral folds of the pia mater were abſolutely neceſſary to maintain equally the ſubſtance of the brain, whoſe fibres are by far too delicate to reſiſt the ſpecific gravity of ſuch a ſoft nervous maſs.

Our mind is naturally inquiſitive, and we unreaſonably wiſh to know more than our faculties will allow; I ſhall be candid to confeſs myſelf guilty of the charge, and purſue my thoughts as far as they poſſibly can reach. Why are there ſoft and hard parts in the brain and nerves? To the firſt part of this queſtion it is rather difficult to anſwer. I imagine that the ſofteſt and inner-

most parts of the brain, either distant or separated in lobes, have the particular faculty of interrupted and continual reflexion, a sense commonly understood by the operation of the mind: But sense had previously its origin through the production of some sensation effected by outward objects; consequently some parts of the brain must be softer than the others, in order that it should be susceptible to keep or retain a continual sensation, and whenever it becomes interrupted, it may be looked upon as a disease, commonly expressed *want of memory*. For example, if I am struck, the sensation is carried to the brain, and I reflect upon it. This I am apt to forget, and I need no sensation to recall it to my mind. Our retina retains the sensation of the rays of light longer than they are effected, for if they become intercepted, we however continue to see them, though our eyes are shut in the dark by way of sparks, and this sensation is improperly called fancy of the sight. This analogy indicates that the retina is nearly alike to the softest parts of the brain. To the second part of the above question, I offer the following comparison for an answer: If we compare the retina with the optic nerve, we will find that nature has designed the first to receive the sensation, and the second to transmit it; therefore, since the rays emitted from objects cannot produce a great shock, it was absolutely necessary that the retina should be softer than the optic nerve: If we compare likewise the portio mollis of the nervi auditorii, its several ramifications in the cochlea, with the commotions of the air vibrating towards the ear, commonly called sounds, we will find that the shock effected by them did not require a soft nervous expansion like the retina. The same comparison may be properly extended to the operations of the senses of smell, touch, and taste.

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When we have been informed by anatomy, that the brain is a kind of white medullary ſubſtance, of a moderate conſiſtence, and of a greyiſh colour on its outer ſurface; that its maſs is of two kinds, diſtinguiſhed by two different effects and qualities; when we have been convinced, as far as diſſections will go, that the extremities of the nerves are appointed to receive our ſenſations, and the reſt to ſerve as conductors, What can we want more? All other inquiries are needleſs for, or towards medical purpoſes. It would be preſumption to enquire whether it is the ſoul or the brain itſelf that think. Such inveſtigations belong to metaphyſicians. I cannot conceive how Deſcartes, Willis, and others, could pretend to explain the functions of the brain and nerves, by attributing to a particular lobe a particular quality; I rather think that they wanted to amuſe the world by imaginary ſyſtems, protected by their great fame. If we will conſider, that the human body is compoſed of fluids, ſoft, and ſolid parts, we muſt naturally conclude, that the ſolids are appointed to ſupport, the ſoft parts to facilitate motion and other functions, and the fluids to nutrify the whole. If theſe great men looked for the ſeat of the ſoul in the human body, I wonder why they ſhould have imagined that its particular ſeat muſt be in ſome part of the brain. They were undoubtedly convinced, that it is immortal or immaterial, and of courſe inviſible; therefore, they could not expect to diſcover it in any particular part of the brain. I recollect a very ſingular paſſage of a treatiſe wrote by Father Craſſet a Jeſuit; it was an anſwer to a book entituled, *Avis Salutaires*. "A highwayman "having faſted every Saturday in honour of the Virgin "Mary, one day that he was executed, his head, on "being ſevered from the body, cried three times as it "flew off, *confeſſion, confeſſion, confeſſion*. A prieſt came

"and

"and put the head on the body. The Devil had taken "hold of his ſoul to drag it into hell; but the Virgin "Mary interpoſed, in order that the ſoul ſhould keep "within the body till confeſſion might be over."—Query, At the time of the ſeparation of the head from the body, Where could be the ſoul? It would appear that Father Craſſet thought it placed in the body, as the head was the organ through which it might only ſpeak. Let the ſoul be whatever it may, it ought to be diffuſed through the whole human fabric; and if by ſome particular eſſence unknown and inexplicable to us, it is ſuſceptible to contract itſelf, that part of the human body which lives the longeſt ought to be its laſt ſeat; conſequently, the right ventricle and auricle of the heart being the longeſt in life or motion, ſhould moſt probably be the ſeat. To purſue this ſubject ſtill farther: The ſoul, as immaterial, muſt be in the blood, becauſe where there is no blood, there is no life; the ſoul, as material, muſt be the blood itſelf, by the ſame reaſon. Whether the firſt or the laſt, the Divine has fully convinced me in favour of the former.

When a perſon is dying, the ſenſual arteries, which penetrate from the dura mater and piæ mater into the very ſubſtance of the brain, vivifying no longer that organ, the operations of the mind ceaſe, and afterwards the *ultimum moriens*, clearly demonſtrated by Galen, Harvey, Boerhaave, and proved by the illuſtrious Haller, takes place. The manner we loſe our ſenſes, in ſtate of life, is ſufficiently accounted for, by the want of blood in the ſenſual arteries, particularly thoſe which nouriſh the ſubſtance of the brain, and ſhows the impropriety of immerſions of cold water over the head to effect their recovery, except when loſt by obſtructions or plenitude of blood in ſuch ſmall veſſels, what in general produce madneſs.—Not long ago, a little boy was brought to me, to

help

help him in the following diſtreſſed ſituation: He had loſt his ſpeech, and was incapable of reflexion. If a tune was plaid or ſung to him, he whiſtled it perfectly well. He appeared frightened at the ſight of a ſtranger, and ſeemed to be entertained by his touch. His eyes were blue, and could ſee at an amazing diſtance. I think that the ſenſual arteries, which vivify the ſubſtance of the brain, were obſtructed, without any other injury to the other parts of that organ. As to the loſs of his ſpeech, I could not account for, as the diſorder took place after his birth. This accident, tho' uncommon, ſhould prompt us to enquire by what mechaniſm the larynx produces the different ſounds of the voice: That queſtion is one of the *inquirenda* in phyſiology to this very hour.

Dimneſs of ſight in old age comes on after an obſtruction or want of blood in the viſual arteries of the optic nerve, or the principal ramifications of the arteria centralis on the retina, what muſt diminiſh their ſenſibility and communicative powers ſooner than the flatneſs of the cornea in changing the direction of the rays of light. In the incipient gutta ſerena, or paralyſis of the retina, a pain in the forehead, or in the orbit, are generally ſymptoms which indicate an obſtruction in the arteria ophthalmica, or its branches: If the light becomes painful to the organ, the circulation in that artery, or its branches, augment the ſenſibility of the retina and optic nerve. However, there are many exceptions to that general rule, eſpecially in complicated caſes, which ſhall be mentioned in their proper place. In a fit of the gout in the lower extremities, the pains generally ſubſide after the inflammation takes place; becauſe then the blood revivifies the nerves, and when obſtruction retakes place, the diſorder and its ſymptoms reappear. A practitioner will have many opportunities to obſerve, that perſons afflicted with nervous com-

plaints,

plaints, and of thin habit of body, are frightened at the leaſt unexpected noiſe, becauſe the blood circulates too freely through the ſenſual arteries, and renders the nerves more ſenſible of quick communicative powers, which overtake the reflexion of the mind about the noiſe. On this principle, I have been directed in practice; and I do not ſcruple to advance, that I have been ſucceſsful to aſtoniſhment in nervous complaints, and particularly in the gutta ſerena, the beginning glaucoma, and inflammations in the lids, which had baffled the applications of general practitioners.

The muſcles are bulks or heaps of fibres, red, midling firm, capable of contraction and relaxation, ſpread in the orbit, as in all the parts of the human body, and from which depend moſt parts of the motions. The fibres whereof the muſcles are formed, are called fleſhy fibres, or motory fibres; they are placed in bundles eaſily diſtinguiſhed with the naked eye, and divided in others ſmaller; theſe, ſub-divided in ſmaller ſtill, without it be poſſible to diſtinguiſh the laſt fibres, which enter into their compoſition: The ſmalleſt that one can perceive, appear folded on their length and placed in zigzags. Some think that they are ſolid, others hollow. Theſe maintain that their cavity is not interrupted; thoſe that they are divided in ſmall cells which communicate with each other. Some ſay that they are filled with a kind of velvet. In one word, there are as many opinions on the elementary fibre, as perſons who have wrote on the ſubject.

As the muſcles well injected are not only tinged in red, but aſſume the colour of the nature of the injection, ſome anatomiſts have thought that the arteries did end in the cavity of the muſcular fibre; other that this effect is owing to the extravaſation of the injection in the cellulary texture which ſurrounds them. The reader may

may eaſily apprehend that theſe different opinions came from inattention or careleſſneſs in diſſections or injections. The nervous and muſcular fibres have exactly the ſame compactneſs, but not the ſame firmneſs; the nervous fibre is naturally ſoft, and the muſcular fibre firm: the nature of the firſt is to receive and convey ſenſation, and that of the ſecond to effect motion; the nutrition of both is operated by the ſame mechaniſm, and it will be evident to ingenious anatomiſts, that the blood which flows through the ſmalleſt branches of the arteries which penetrate in the fibres, does not return, but ſerves to their nutrition. This is obvious in diſſections, as the ſmalleſt branches of theſe arteries cannot be traced ſo as to demonſtrate to us their connections with any veins: It follows from this principle, that the number of the arteries exceeds that of the veins by far, and that anatomiſts have often taken for veins many of the arteries above mentioned.

Whenever the proceſſus ciliaris, which ſupport the vitreous and cryſtalline humors towards the poſterior parts of the inſide of the globe of eye, have loſt their power of elaſticity, the vitreous body, and the cryſtalline lens, puſh the iris forward, and there remains no chambers in the eye. When that takes place, the aqueous humor flows out of the globe through the inorganic pores of the cornea, and by that diſorder the vitreous humor increaſes in bulk, the pupil becomes extremely dilated, and keeps an oblong figure in moſt of theſe caſes; beſides, the capſule of the cryſtalline lens being in contact with the iris, becomes opaque, the arteries which correſpond with the *venæ vorticoſæ* of the iris do not circulate, pains in the forehead, temples, are continually increaſing. If the bulk of the vitreous humor increaſes to a degree ſo as to preſs on the choroides, the *venæ vorticoſæ* of that vaſcular membrane cannot receive the blood from

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the ciliary arteries, then inflammation takes place with intolerable pains in the head. If the patient is bled at the arm or temporal artery, the pain will ſubſide for a while, and return again with more violence. If the ſame ſymptoms are exiſting without the ſame cauſe, bleeding, aſſiſted with emollient fumigations, will diſpel the complaint without return.

The lacrymal artery at its inſertion in the glandula lacrymalis is divided into ſeveral ſmall and ſhort branches, and theſe in ſmaller ſtill. The blood, when arrived in theſe ſmall ramifications, becomes lymph, and afterwards is ſecreted through the ducts of the conjunctiva, to conſtitute part of the tears. Nature does not preſent us with the ſame reſults, whenever the arteries have no correſponding veins; for which reaſon, we meet with two lacrymal arteries, and from that variation derives miſtake. If there are ſeveral arteries, their principal trunks are a great deal ſmaller than when there is but one; and, in ſuch caſes, the diſorders in the organ are more or leſs frequent. Many of the other arteries experience the ſame circulation, except thoſe which nutrify the parts; and thoſe which have correſponding veins cannot be but conjectured, from difficulty in diſſections which require ſawing the orbit at ſeveral places, before one is able to obſerve their ſituation. The fineſt and moſt lucky injections through the jugulary veins and carotid arteries, followed by cautious and dexterous diſſections, have plainly convinced me of what I have advanced above. Anatomiſts who will go through the ſame trouble and expence, may receive the ſame information; but I queſtion whether they ſhall have ſufficient opportunities for it, and practice to help them through ſuch difficulties. A few caſes which have occurred to me will further illuſtrate the ſubject;

ſubject; and ſome remarks relative to them, ſeem altogether abſolutely neceſſary.

Henry Warrington applied to me in December 1782 for an inflamation on both eyes, attended with violent pains. Before I ſaw him he had been bled three times at the arm, and once at the temporal artery, in the ſpace of five days. He had ſome relief from the loſs of blood; but the diſorder returned with more violence a few days after. Bliſters behind the ears, and on the nape of the neck, were made uſe of, with ſome purgatives, and yet the diſeaſe increaſed, even with theſe medicaments; he could, however, bear the light in that ſtate. The cornea was ſound, but elevated, and the pupil of the left eye did contract and dilate in ſome degree; but the right was motionleſs, when I ſaw the caſe for the firſt time. The blood veſſels of the iris were ſo diſtended and full, that this vaſcular membrane looked like an anatomical preparation well injected. I preſcribed emollient fumigations every two hours, for ten minutes, each eye at a time, and, during the intervals, compreſſes dipt in the emollient infuſion. Three days after, the iris of the left eye appeared leſs red, but there remained ſome white ſpots upon it, at ſome diſtance from each other; theſe were puſtles which changed in ſmall ulcers, and ſubſided the ninth day. The right eye continued painful, and many fibres of the iris were puſhed forwards in form of ſmall reddiſh threads, which afterwards became adherent to the cornea, and the pupil took an unnatural ſhape. The left eye cured in ſome degree, but the right was irrecoverably loſt.

Remarks. The right eye began to be inflamed three weeks before the left, and it was evident that the ſtagnation of the blood, in the veſſels which ramificate the iris, had ſubſiſted too long to give way to the medicaments.

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The original cauſe of the complaint was an alteration in the fluids, and a preſſure on the veins, as the globe of the eye was exceſſively extended. It is probable that the fumigations, applied in time to the left eye, relaxed the globe, and promoted circulation; but being applied too late for the right eye, the blood, by a too long ſtagnation in the blood-veſſels, became acrimonious, and this brought on the rupture of the veſſels, and of courſe the loſs of the organ. The diſtenſion of the globe was produced by an increaſe of the vitreous humor. The inorganic pores of the cornea were not able to emit the aqueous humor, in proportion to the augmentation of the vitreous, conſequently, the vitreous body, becoming too bulky for the extenſion of the coats of the globe, the choroides was preſſed, and the veins could not take up the blood continually ſupplied by the arteries, notwithſtanding the preſſure to carry on circulation. In that caſe, ſuch of the lymphatic arteries and veins as ſerve of nutrition to the iris, were diſtended and full of blood, which became acrimonious, and produced the ſmall ulcers above mentioned. Theſe lymphatic arteries and veins being alſo diſtended, far beyond their power, they never were able to re-aſſume their elaſticity by the help of the medicaments;—and this accounts for the loſs of the right eye.

Miſs Benſon, aged 30 years, applied to me in February 1784, to give her ſome aſſiſtance in her trouble. Both eyes were cataracted; the right eye was free of pain, and the left ſo painful, that ſhe could take no reſt for ſeveral nights together. The ſight of both eyes being paſt cure, I preſcribed five and twenty drops of laudanum at bed time in a cup of plain water, and increaſed ſucceſſively the doſe to fifty drops in the ſame quantity of water. She obtained relief, and the pains ſubſided entirely in the courſe of a month. Here is an account

count of the ſtate of the caſe and its progreſs. The proceſſus ciliaris of the left eye loſt their elaſticity, and in conſequence of that, the vitreous body and cryſtalline lens had come forward in the poſterior chamber, cloſe to the iris. In courſe of time, they projected by degrees to the anterior chamber, and when the aqueous humor had entirely evacuated through the inorganic pores of the cornea, the iris became in contact with it. As they could advance no further, the coats of the eye extended as much as poſſible, and when this could no longer be the caſe, the pupil dilated, the iris became preſſed between the cornea and the anterior part of the vitreous body and cryſtalline lens; this preſſure ſtopt the circulation between the ciliary arteries and the correſponding veins of the choroides and iris; from that diſorder, intolerable pains in the forehead, temples, and the ball, without any external inflammation of the eye.

I have obſerved, that in the ſwelling and hardneſs of the globe of the eye, the cornea projects more than common, the pupil dilates difficultly, and that the ſymptoms are great pains in the head, temples, and the internal parts of the eye. When this is the caſe, the retina muſt be preſſed by the poſterior parts of the vitreous body, if the proceſſus ciliaris keep their elaſticity. The arteria centralis, and the viſual arteries of the optic nerve, muſt likewiſe enlarge, and viſion becomes leſs and leſs, as the parts are every day wanting their nutrition from the blood, whoſe circulation is intercepted by preſſure. If the branches of the arteria ophthalmica, which penetrate into the ſubſtance of the optic nerve and retina, had correſponding veins, ſuch diminution of ſight to blindneſs could never take place ſo ſuddenly. If the varicous veſſels, which I take to be real arteriols, extend from the conjunctiva over the cornea, and ſometimes penetrate into the ſubſtance of that tranſparent membrane, had

correſponding

corresponding veins, I cannot conceive how veins could grow as these arteriols and meet them; for they are generally annihilated by the frictions of the lids over the globe of the eye, or removed by chirurgical and medical operations.

The above cases tending only to prove a partial circulation of the blood through the arteries and veins of the eye, the following will illustrate the vivification of the brain and nerves. On the 17th of February 1721, a woman about 26 years of age, received a wound by a pistol clapped to her head. The wound was situated at the inferior part of the right parietal, between the temporal bone and the right ear. The motions of the brain were excessive and increased daily. A grinding of the teeth, delirium, and fever, preceded by shiverings constantly attended each dressing, but a calm succeeded for six or seven days, after which the same symptoms returned, with a copious suppuration, proceeding from the very substance of the brain, which washed off five shots and three slugs lodged in a fungous excrescence. The quantity of pus decreased when these extraneous bodies were discharged, whose weight had occasioned an inflammation before. She languished in a dying manner for thirty five days; at last the delirium and lethargy ceased on a sudden, after this extraordinary suppuration, and the patient recovered her senses. There was a sensible regeneration of the dura mater, the bones and wound were healed in the space of four months. She continued in a good state of health, except that she was sometimes troubled with vapours, and a slight heaviness.

On the 20th of August 1765, a young gentleman of Corsica received a blow on the head with a knotted club stuffed with 20 or 30 steel nails at the end. The nails were long enough to penetrate into the substance of the brain. He was trepanned and treated the common way,

way, and recovered from all the accidents attended with loſs of ſubſtance. I ſpoke with him at Paris in the years 1775 and 1779. He ſhowed me a ſilver box containing a piece of his ſkull taken off with the trepan, and told me that whenever he drank wine or any other ſpirituous liquors, he always loſt his judgment, let the quantity be ever ſo ſmall; and whenever he became intoxicated, he turned convulſed and furious mad, and remained for ſome days ſo ſtupified, that he had no recollection of any paſt tranſaction. He was even ſo nice in his taſte, that he could tell, when he eat any pudding wherein a few drops of ſpirits had been mixed.

Remarks. The firſt caſe ſhows, that we cannot loſe any part of our brain without ſome detriment in our reflection, and the ſecond, that there is no difference between each lobe of the brain; for, if there was, the ſound part would perform its functions, and the diſordered produce ſenſations of pain relative to the injuries done. Theſe caſes and a great number of others of the ſame nature ſhow likewiſe, that whenever ſome ramifications of arteries, which convey nutrition to the internal part of the brain, are deſtroyed, dullneſs and ſtupifaction muſt take place; and that the principal trunks of theſe arteries and ramifications which ſubſiſt, being of a larger diameter, muſt convey into the brain the ſpirituous fluid diſengaged from its groſs parts, and produce ſudden drunkneſs and madneſs. Thoſe who are uſed to hard drinking and inflammations of the brain, ought to have their ſenſual arteries very much enlarged; and if they reaſſume their elaſticity or tone, they however are ſuſceptible to enlarge again with more facility, and by time loſe their judgment without a return. Such perſons as labour under theſe defects of faculties, ſhould live upon a milk diet, which would obviate the above diſeaſe.

diseafe. The functions of the brain and nerves, together with their nutrition, being of great use towards the explanation of the fenfes of hearing and vifion, I could not leave out without fome impropriety, as *Steno*, in a learned differtation on the brain, and quoted by Winflow and other anatomifts, feems to acknowledge that he is entirely ignorant about it; and that the moft modern anatomifts have faid no more, nor made any further progrefs concerning its determined functions.

Dr Alexander Monro, in his obfervations on the ftructure and functions of the nervous fyftem, publifhed in folio, in the year 1783, and illuftrated with common etchings, has the following paragraph, chap. x. § iii. page 33. "If we do not admit that the pia mater "accompanies the medullary matter of the retina, or "portio mollis of the ear, How are we to fuppofe the "accompanying blood veffels to be fupported? How "are we to explain the difference of their color, or the "greater bulk and greater toughnefs of them than of "the pure medullary matter fent off from the brain, "cerebellum, and fpinal marrow?" I have often wondered that the Doctor could not folve thefe eafy queftions without grafping at evident errors. I am apt to believe, from his own expreffions, that he has only gueffed things, and accounts for them on that fcore, or elfe he would have roundly proved them by the very fame diffections that he feems to be at a lofs.

Let us folve his queftions without prolixity. How is the medullary matter of the retina fupported without the pia mater? The retina is not a medullary matter, but a nervous medullary expanfion. How is the retina fupported without the pia mater? By the ophthalmic and ciliary arteries, defcribed page 5. and 20. Some of thefe arteries enter the globe near, and round the optic nerve, others penetrate laterally through every coat; and, in running

running directly into the vitreous body, they support equally the retina. As to the portio mollis of the ear, See the Physiological Enquiry into the Human Ear. How are we to explain the difference of color in the brain, cerebellum, and spinal marrow? The choroides and the internal surface of the pia mater are equally vascular, and the smallest ramifications furnishing these coats more immediately, the grossest parts of the blood are deposited on them. On the choroides to absorb the rays of light, and on the external surface, called cortical substance, for the purpose of centering our sensations on the soft parts of the brain. This physiology has been treated of in its proper place.

PHYSIOLOGICAL ENQUIRY

INTO THE

PROPERTIES OF LIGHT, AND THE THEORY OF SIMPLE VISION.

OUR ſight is the moſt perfect and moſt delightful of all our ſenſes. It fills the mind with the largeſt variety of ideas, converſes with its objects at the greateſt diſtance, and continues the longeſt in action without being tired or ſatiated with its proper enjoyments. The ſenſe of feeling can indeed give us a notion of extenſion, ſhape, and all other ideas that enter at the eye, except colors; but, at the ſame time, it is very much ſtraitened and confined in its operations, to the number, bulk, and diſtance of its particular objects. Our ſight ſeems deſigned to ſupply all theſe defects, and may be conſidered as a more delicate and diffuſive kind of touch, that ſpreads itſelf over an infinite multitude of bodies, comprehends the largeſt figures, and brings into our reach ſome of the moſt remote parts of the univerſe.

It is this ſenſe which furniſhes the imagination with its ideas; ſo that by the pleaſures of the imagination or fancy (which I ſhall uſe promiſcuouſly) I here mean ſuch as ariſe from viſible objects, either when we have them actually in our view, or when we call up their ideas into our minds by paintings, ſtatues, deſcriptions, or any the like occaſions. We cannot indeed have a ſingle image in the fancy that did not make its firſt entrance

trance through the ſight; but we have the power of retaining, altering, and compounding thoſe images, which we have once received into all the varieties of picture and viſion that are agreeable to the imagination: for by this faculty, a man in a dungeon is capable of entertaining himſelf with ſcenes and landſkips more beautiful than any that can be found in the whole compaſs of nature.

Every body knows that *things* would make but a poor appearance to the eye, if we ſaw them only in their proper figures and motions. And what reaſon can we aſſign for their exciting in us many of thoſe ideas which are different from any thing that exiſts in the objects themſelves, (for ſuch are light, and colors of which I have been juſt ſpeaking above) were it not to add ſupernumerary ornaments to the univerſe, and make it more agreeable to the imagination? We are every where entertained with pleaſing ſhows and apparitions; we diſcover imaginary glories in the heavens, and on the earth; and we ſee ſome of this viſionary beauty poured out upon the whole creation. But what a rough inſightly ſketch of nature ſhould we be entertained with, did all our coloring diſappear, and the ſeveral diſtinctions of light and ſhade vaniſh? In ſhort, our ſouls are at preſent delightfully loſt and bewildered in a pleaſing deluſion, and we walk about like the enchanted hero in a romance, who ſees beautiful caſtles, woods, and meadows; and, at the ſame time, hears the warbling of birds, and the purling of ſtreams: but upon the finiſhing of ſome ſecret ſpell, the fantaſtic ſcene breaks up, and the diſconſolate knight finds himſelf on a barren heath, or in a ſolitary deſart. It is not improbable, that ſomething like this may be the ſtate of the ſoul after its firſt ſeparation, in reſpect of the images it will receive from matter; though indeed the ideas of colors are ſo

pleasing and beautiful in the imagination, that it is possible the soul will not be deprived of them, but perhaps find them exciting, by some other occasional cause, as they are at present by the different impressions of the subtle matter on the organ of sight. I have here supposed, that my reader is acquainted with that great discovery, which is at present universally acknowledged by all enquirers into natural philosophy, namely, that light and colors, as apprehended by the imagination, are only ideas in the mind, and not qualities, that have any existence in matter. As this is a subject that has been proved incontestably by many philosophers, and is indeed one of the finest speculations in that science, if you would see the notion explained at large, you may find it in the eighth chapter of the second book of Mr Locke's Essay on the Human Understanding, it being not of my competency here.

Optics is a science which teaches the nature, properties, and laws of vision, arising from the rays of light, either reflected from the surfaces of bodies, or refracted in passing through them, and touching the retina on the bottom of the eye. This science comprehends also, in its most extensive acceptation, the whole doctrine of light and colors, and all the phænomena, or appearances of visible objects. Optics, therefore, consists of three parts, *viz.* catoptrics, dioptrics, and chromatics; but all these subjects being too much for my work, I shall only speak of the doctrines of light and natural vision.

The Sun is the great illuminator of the day, a glorious planet, the spring of light and heat. This luminous globe sends forth flashes of light all over the world, and, by its presence, constitutes the day. Its substance is a fiery matter, or fluid, which is continually expanded in the air, if not intercepted; because it lightens, and

and that its rays, gathered by concave mirrors, or convex glasses, burn, consume, and melt the most solid bodies, or even turn them into ashes or glass. It is from this luminous Being that light propagates itself every way, and that the rays which come from it spread on all sides in right lines, and with a swiftness almost incredible; for if a dark room be suddenly opened, this very luminous matter, or fluid, is immediately and uniformly propagated into it, according to the laws of reflection and refraction; and if you intercept the communication through which it went in, it vanishes as fast as it came in. Light spends about seven or eight minutes of an hour in passing from the sun to the earth; that is to say, in running over a space of 23,000,000 or more leagues, its swiftness is 10,000,000 times greater than that of a bullet which goes out of a gun.

The attraction of one ray of light, considering its quantity of matter is to the gravity that has a projectile, considering also its quantity of matter in compounded *ratio* of the swiftness of the ray, to that of the projectile, and of the bending of the line that the ray is drawing in the refraction, to the crookedness of the line that the projectile describes also on its side; provided, however, that the leaning of the ray on the refracting surface, be the same as that of the direction of the projectile upon the horizon; from this proposition, it follows, that the attraction of the rays of light is more than 1,000,000,000,000 times greater than the gravity of the bodies upon the surface of the earth, considering the quantity of matter of the ray and of the terrestrial bodies, and in supposing that the light spends from the sun to the earth seven minutes of an hour. The velocity of light cannot be retarded, but only diminished to a degree of proportional transparency of the body which intercepts it, unless it be admitted in a dark room through

through a hole to which a denſer body than the air is objected.

The rays of light are ſmall corpuſcles, which move with a great deal of ſwiftneſs from the luminous body. What ought to make us diſtinguiſh light into two ſpecies is, that it is an heterogeneal mixture of rays differently refrangibles. That, whoſe rays are equally refrangibles, is called homogeneal, ſimilar, or uniform light; and that, whoſe rays are inequally refrangibles, is called heterogeneals. The light of the ſun conſiſts in rays, which differ from each other by indefinite degrees of refrangibility: the rays which differ in refrangibility, will differ alſo proportionally in the colors they are to repreſent when they will have been ſeparated from each other: there are as many ſimple and homogeneal colors, as degrees of refrangibility. The rays of light are a compound of diſſimilar or heterogeneal parts, ſome being very likely greater than the others: conſequently the ſmaller thoſe parts are, the more they are refrangibles; that is to ſay, the eaſier they divert from their rectiline ways; moreover, the parts which differ in refrangibility, and of courſe in volume, differ at the ſame time in color; from theſe principles, the whole theory of colors may eaſily be deduced. The expanſion or ſpace of the propagation of the parts of light is not to be conceived. Dr Hook ſhews, that it has no bounds but with the univerſe; and he proves it by the immenſe diſtance of ſome fixed ſtars, whoſe light is however ſenſible to our eyes by the help of a teleſcope. It is not only the great bodies of the ſun and ſtars that are able to ſend forth their light to the remoteſt points of the immenſe ſpaces of the univerſe, the ſame may be with the leaſt ſpark of a luminous body, even with the ſmalleſt globule the flint of a gun will produce out of the ſteel. A great many various examples teſtify the artificial

ficial production of light by the attrition of bodies which are not naturally luminous; as amber rubbed upon a woollen coat, glaſs upon a woollen ſtuff, glaſs upon glaſs, oyſter-ſhells upon a woollen ſtuff, and woollen ſtuffs upon one another, the whole in *vacuum*.

All fixed bodies, when they have been heated above a certain degree, become luminous; a quality they appear indebted to the motion of vibration of their parts. In ſhort, all bodies which abound in terreſtrial and ſulfureous parts, produce ſome light, if they are ſufficiently agitated in what manner ſoever. Thus the ſea becomes luminous in a tempeſt; quick ſilver, when it is ſhaked in vacuum; cats and horſes, when they are rubbed in obſcurity; wood, fiſh, and fleſh, when rotten. The different ſpecies of bodies produce different ſpecies of light, which differ either in color, ſtrength, &c. and the ſame attrition has various effects, according to the different preparations of bodies that bear it, or the different manner of rubbing them; and that the bodies which have produced a certain light in particular, may be incapable by the friction to produce any more of the ſame ſpecie. Mercury, amalgamated with pewter, and rubbed upon glaſs, produces in the air a great light.—Gold alſo produces it, and to a greater degree. Finally, of all theſe ſpecies of light produced artificially, the moſt perfect is that produced by the attrition of diamond, which is as dazzling as that of a red coal which is forcibly blown upon.

The fundamental principle of the whole optic ſcience is, that light propagates itſelf according to a right line, in a manner that is leſs unknown to us; and the right lines, according as it propagates itſelf, are called rays. The leading principle of catoptric is, that the rays of light are reflected by an equal angle to that of incidence. The rays of light which go from one *medium*

in

in another, are broke in ſuch a manner, that the ſine of incidence is to the ſine of refraction in conſtant *ratio*: this laſt is the principle of dioptric. With theſe very ſimple propoſitions, the theory of light becomes merely a geometrical ſcience; and all its properties are demonſtrated, without knowing poſitively in what it conſiſts, nor how its propagation is effected.

Light is ſo ſubtile, that its particles are not ſuſceptible of gravitation; becauſe, when once expanded into the air, it cannot be diſperſed, but only intercepted. The artificial light may be looked upon as an emblem of the primary's. The impreſſion of the rays of light on the *retina* continue as long as they are admitted upon it, and immediately ceaſes, as ſoon as they are off.

Viſion is as eaſy to conceive, as it has till now ſeemed difficult. If you will take upon yourſelf to obſerve attentively the hiſtory and preſent ſtate of the diſcoveries relating to viſion, you will ſee, that a great many falſe applications of the experiments, made upon this head, have much contributed to put off the real knowledge of it; and then you will be no longer at a loſs how to find out the cauſes, and even wonder why they have not been removed ſooner. How came it to paſs, that all direct rays croſs each other, before they arrive upon the *cornea*, or any other convex tranſparent bodies, from the points of their emiſſion? Is it becauſe there is an invertion of pictures upon the *retina*, or that the repreſentation of objects on a ſheet of white paper, by means of a lens placed at a hole in the window-ſhutter of a dark room, is perfectly ſimilar to our eyes, according to phyſicians, opticians, and philoſophers? How came it they could grant, that objects are ſeen perfectly or imperfectly, when pictures are painted perfect or imperfect upon the retina? Is it becauſe the refractions of the rays of light through the tranſparent capſules and humors of the eye, unite and

TAB. III.

Fig. 1.

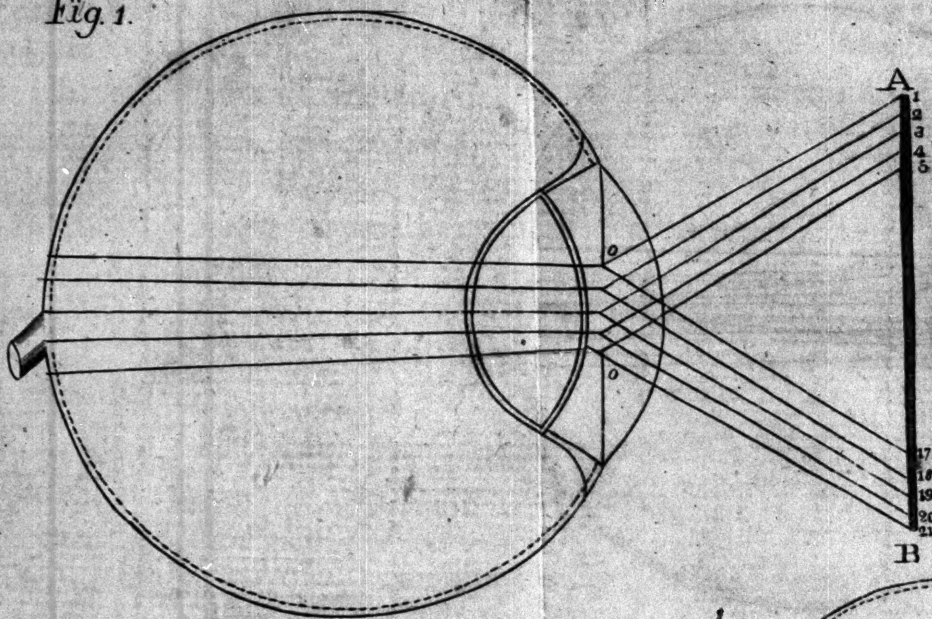


Fig. 3.

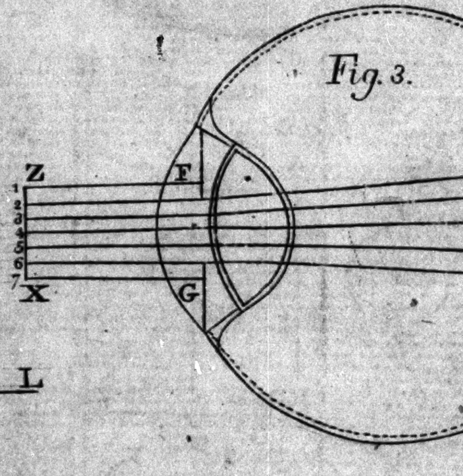
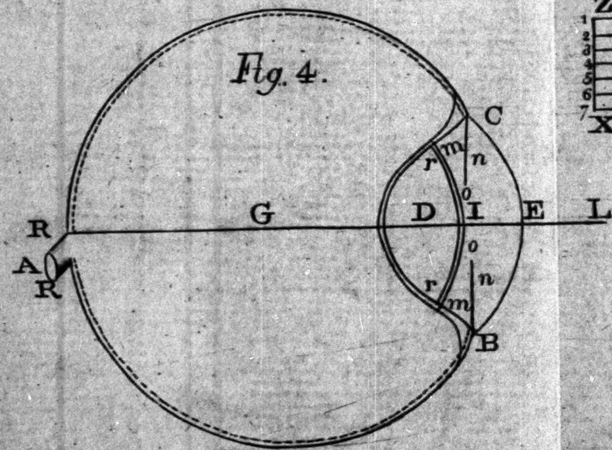


Fig. 4.



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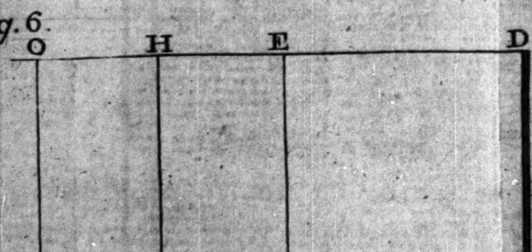

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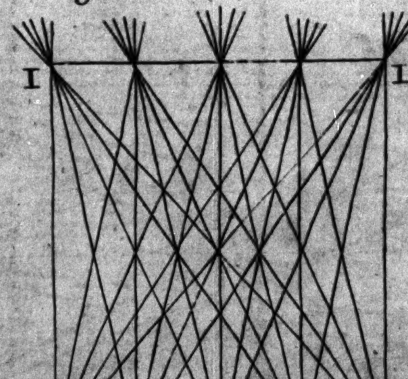


B. III.

Fig. 2.

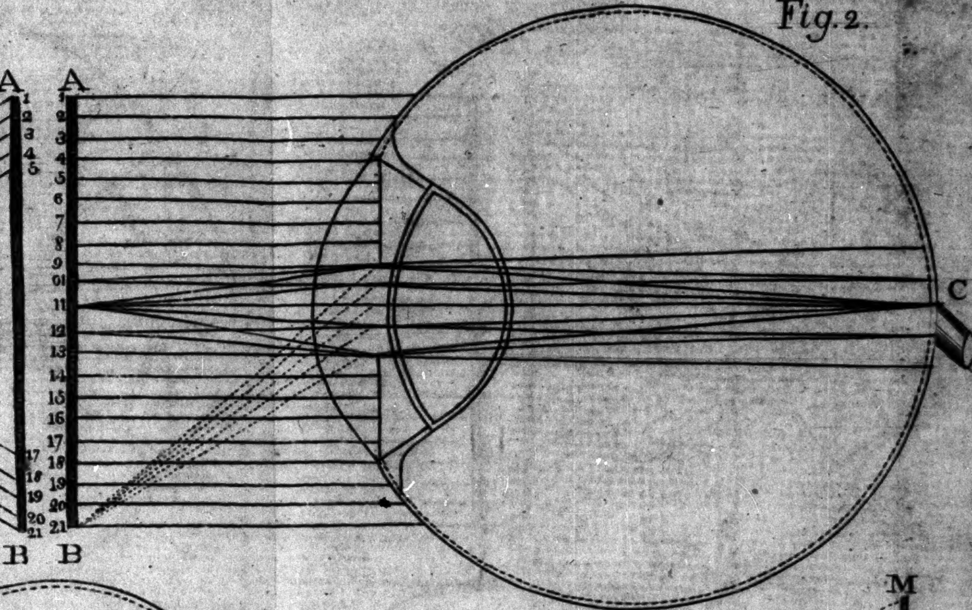


Fig. 3.

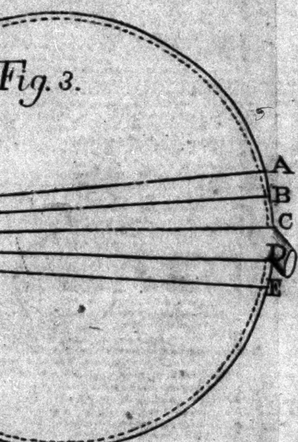
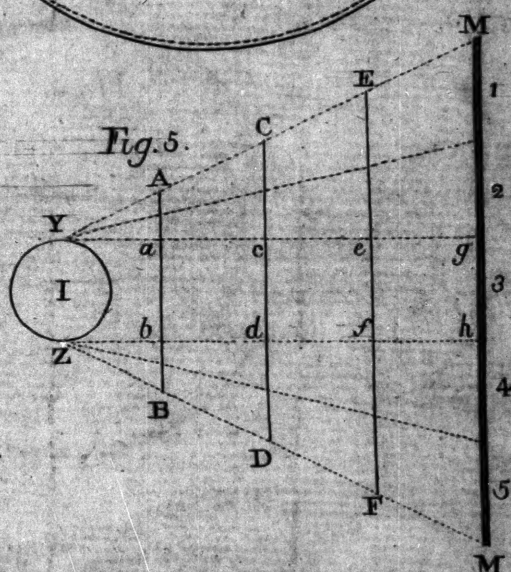


Fig. 5.



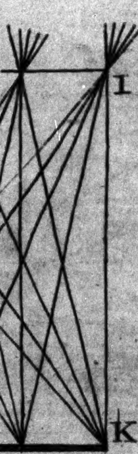


Fig. 8.

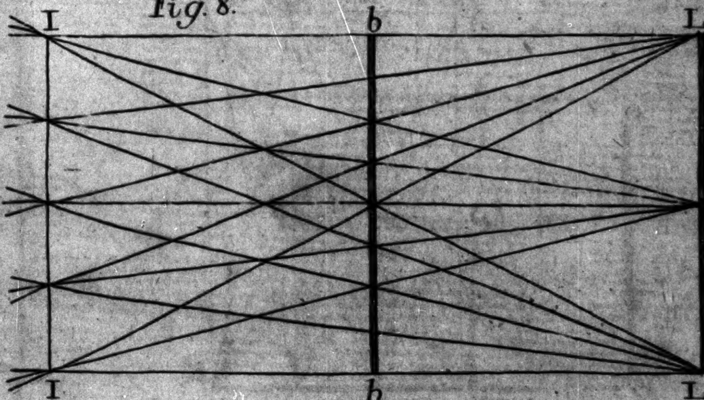


Fig. 1.

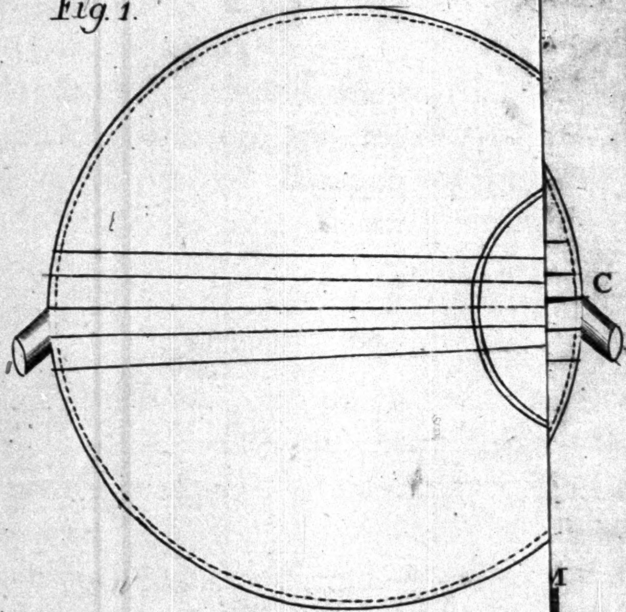


Fig. 4.

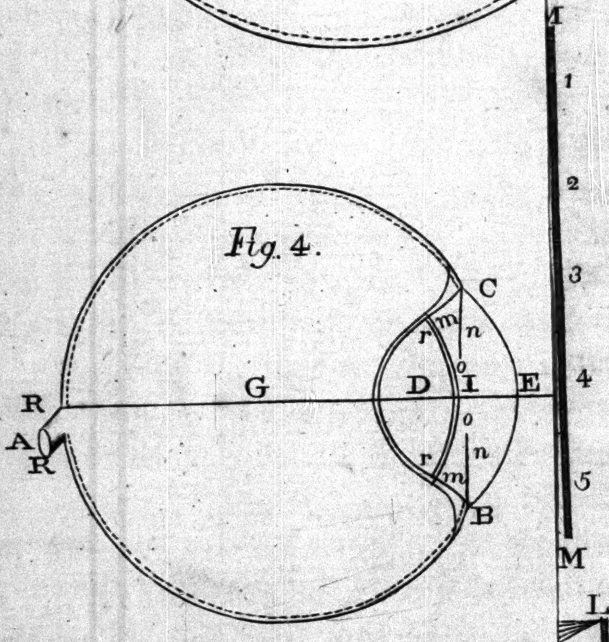
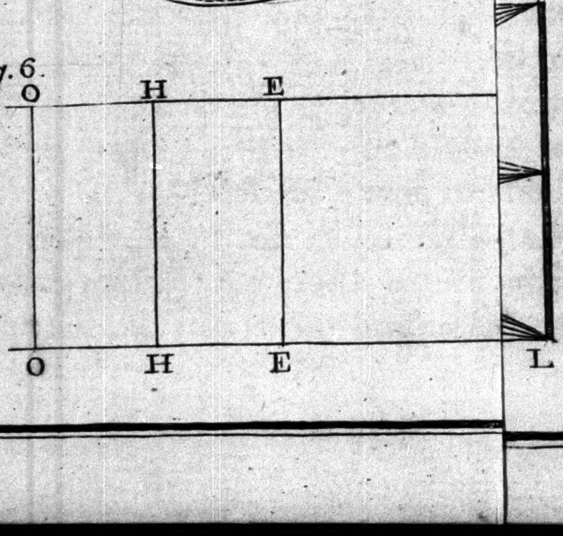


Fig. 6.



and bring together the rays which come into the eye from the ſeveral points of the object in ſo many correſponding ones, and paint the image of the object upon the *tunica retina* that lines the bottom of the globe; which image being propogated by motion along the fibres of the optic nerve up to the brain, is the cauſe of viſion. What a ſtrange imagination, to ſet forth that our ſenſations are produced only by the concourſe of the animal ſpirits in the nervous fibrils, and various contacts of objects that ſtrike our ſenſes! Is it on the probability that the animal ſpirits are nothing elſe but an electrical fluid, which is the efficient cauſe of our ſenſations?—Every ſenſible man who applies himſelf to ſo delicate a branch as that of the treatment of the diſorders of the eyes, who has ſtudied all the authors that have written upon this ſubject, who knows perfectly well the ſyſtems, theory, and practice of thoſe that have acquired a great name and deſerve the confidence of the public; who has in view the perfection of this branch of phyſic and chirurgery, when he thinks it ſuſceptible of it, cannot help ſeeing with aſtoniſhment ſo little progreſs in ſo many centuries. As for my own part, I will take upon me to advance, and prove, that all the ſyſtems, theory, and practice, though in many reſpects built and invented by phyſicians and philoſophers of the moſt diſtinguiſhed geniuſes, are very far from the real knowledge of the anatomy and phyſiology of the human eye, and that they have launched themſelves in conjectures, and drawn conſequences from them, as abſurd, as they could be of very little uſe to the object of ſimple and natural viſion, and promoting proper methods to cure its defects.

The works publiſhed by the modern writers are in a manner ſo oppoſite to thoſe of the antients, that one needs not go far to find out the cauſe. The latter be-

gan by tracing plainly and exactly the discoveries; their followers copied them with the improvements; but if, as it happens now-a days, they continue to contradict each other in order of acquiring a reputation, what shall be the consequence? A stop to the progress of this delicate art.

This part of my treatise, though an abstract or compendium, may be considered as elements particularly depending upon this branch of medicine already too long in the dark, as it was dispersed in a great many books of different subjects. Besides, one might look upon it as new elements in the optical science, as the whole is founded upon the first principles adequate to it.

In so short a description of vision as this, my intention is not to display all the systems that have been invented, nor give the analysis of every one of those that have been published in the several treatises of optic, dioptric, catopric, &c. to establish mine upon the ruin of them; because I should be obliged to waste away more paper and time than they are worth for my present work, as I reject them all. Such an analysis and enquiry will be, I imagine, not only amusing, but useful, as it will be an ample instruction in this science; at least, it will be more so than any rhapsody of general reflections, huddled together with little order or design, for these leave no systematical impressions on the mind; nothing but a confussion of ideas, often bright and glittering, seldom instructive. And a work of this kind would be too voluminous, and too aspiring for this little essay or *compendium*, and the humble author of it. I will therefore keep to my point, and content myself with making some of those observations alone, which seem proper to illustrate and prove what I have advanced; That natural and simple vision is not yet known, or at least explained as it ought to be; and that no author

thor has given any phyfical reafons concerning it. In order, therefore, that I may give fome more fatisfying account how this noble fenfe is produced, I think it is abfolutely neceffary to premife the following principles.

The rays emitted from objects which furround us go to the *tunica retina*, and make an impreffion againft our will, provided our eyes be open; but of a quantity of rays which are emitted from a quantity of objects, there is but one of thefe objects that takes up our reflection. The rays emitted from an object pafs into the very bottom of the globe of the eye, if they are not intercepted in their direct way without the globe; becaufe the capfules, and humors it comprehends, are tranfparent.

Suppofe, (Fig. 4. Tab. I.) an object, marked by a point, indicated L, from which a fingle ray is emitted and fent forth into your eye, when you ftand motionlefs; the ray fhall pafs through the center of the *cornea* at the point E, the pupil I, through the chryftalline D, and, croffing the vitreous humor G, it fhall ftop on the *retina* R, and be abforbed there by the *meconium* that lines the *choroides*. As foon as the ray is arrived upon the immediate organ of fight, a fenfible touch, which is propagated to the brain, is given upon it; from thence SENSATION. This operation performed, you reflect about the object from whence the ray is emitted, whether upon its colour, if you have a primary knowledge of colours, or about its roundnefs and other forms by the fame reafon; then you form an idea of it in yourfelf; from thence CONCEPTION. If this ray was not abforbed upon the *retina* to the point R, it would continue its way to the furface of the *choroides* or *fclerotica*, if it was no more abforbed on the choroides than on the retina, without producing a complete fenfation: In this laft cafe, your organ is deprived of that agreeable fatisfaction which we

call

call ſeeing, though day from darkneſs might be diſtinguiſhed.

I will, however, make an obſervation here, which is, that there are ſome animals whoſe chorides are void of *meconium*, and who enjoy, for all that, the faculty of ſeeing. But ſuch a fact cannot be any objection of weight, that, by its abſence, a man whoſe organ would be deprived of it, could be bereft of ſight; becauſe it matters very little if the rays be abſorbed by meconium, or by any other diſpoſitions or conſtitutions of the parts which make up the eye of theſe animals. The abſorption of the rays of light in the ox's eye is performed by a tincture of mixt green and blue; for which reaſon, I think thoſe animals or others as have ſuch eyes, cannot ſee the objects as diſtinctly as we do. Beſides, the cornea being thicker, and the humors denſer, the refraction is alſo in proportion to it; and the choroides being alſo different, muſt of courſe produce ſeveral varieties. My intention being confined to the natural viſion of man, I ſhall not pretend to enlarge upon the ſubject, though it might be very curious and entertaining to many of my readers; but when I conſider about many more intereſting ſubjects which fall to my ſhare, I preſume it would be rude to detain them any longer about it. What is moſt certain, according to many obſervations, is, that there are in general no man who can ſee in ſuch a ſtate; that is to ſay, without *meconium* on the choroides.

The ſingle ſenſation produced on the immediate organ of ſight by ſome rays emitted from an object, is not ſufficient, even with the help of reflection, to make it conceivable in all its qualities and modifications, if you are totally ignorant of the various ideas it may preſent. A cataracted born-blind man who has undergone the operation

peration of extracting, is an irrefragable proof of this assertion.

The basis of this system is, that the nervous system is the principal of our sensations; and that our conception is effected by two operations, SENSATION and REFLECTION; that we feel without reflecting. But that this last operation cannot exist without the first, is a fact disputed by nobody. Thus, when we have reflected on any object whatever, a sensation must have preceded; consequently sensation and reflection are dependent upon each other to produce simple perception. A fool is susceptible of feeling when he is struck, but not of reflecting about the object that strikes him, and what may be the reason; because, if he did reflect, he would cease being a fool the very moment of the reflection, which is a knowledge the mind takes of its proper operations, and their manner of operating. In our first born days, we have the faculty of feeling to a certain degree, without having that of reflecting; otherwise it would necessarily follow, that we have innate ideas, and that exterior objects do not produce our simple ones, what would be as ridiculous as absurd.

The whole extent of the retina is susceptible of receiving the impressions of the rays of light; but the more rays taken in, the more the sensation is felt. When an object is considerable in its extent, and near the eye, all the rays which are emitted from it in right and oblique planes, cannot be admitted in the bottom of the eye, without some of them be intercepted; therefore we cannot perceive and conceive the whole object at the same time, and such as it is, without surveying successively all the points, (when I say all the points, I mean such a quantity of them as are in proportion to the pupil's diameter, with regard to the distance from the object to the eye, that produce a perfect vision of such

ſuch a part of the object) by the help of motions of the globe or head; becauſe the rays that contributed to the reflection about that part of the object perceived, are independent of all thoſe that croſs each other by numberleſs inclinations, before they come upon the *cornea;* that is to ſay, the rays which are emitted from the ſuperior extremity of the object, ſuppoſing it be placed vertically and of a long figure, do not come (after their inſertion in the globe) to the inferior part of the circumference of the pupil; and thoſe emitted from its inferior extremity do not paſs to the ſuperior part of the circumference of the pupil, to arrive from thence on the immediate organ of ſight, as I ſhall demonſtrate it hereafter. Were it not thus, the perſon could perceive and conceive the object entirely and at the ſame time, without any motion of the globe of the eye, or of the head, or of both together; what cannot exiſt according to the following experiment.

Deſcribe upon a ſmooth white wall, expoſed to a very clear light, a black tranſverſal *line* of one inch in breadth and ſix feet in length; ſhut one eye with the tip of your finger, and fix at the ſame time, (if you can) the extremities of the black line with the other eye only at one foot diſtance; then you ſhall perceive, that the globe of the eye ſhut, moves under your finger, to perform the ſame motions of the open eye with which you endeavour, but in vain, to fix the black line entirely. Go back at ſix feet diſtance, one eye always open, and the other ſhut, you will obſerve, that the globes are not ſubject to ſo extenſive motions as they were at one foot diſtance. Go back till you ſee the black line without any motions of the globes and head, then you will eaſily conceive, that the remoteneſs of the object and its diameter, are viſibly become proportioned to that of the pupil; therefore all the rays emitted from this black

line

line have their direct paſſage into the bottom of the globe of the eye, conſequently all the rays, when near, being not able to arrive in the eye directly, have no power on the reflection, ſince the eye is obliged to move for ſurveying every point of the object, to make you conceive a perfect idea of the whole by ſucceſſion of time. Were I to enquire here minutely into the phyſical laws of the power of the rays, on the immediate organ of ſight, emitted from objects at a given diſtance, I might no doubt determine by that method at what diſtance ſuch an object, of ſuch a quality, and of ſuch an extent, might diſtinctly be perceived: but when I reflect upon the variety of the ſenſibility of the *retina* in mens eyes, together with the reſpective faculty of the contraction and dilatation in the pupils, my pen ſtops ſhort with my abilities. If a man, able of ſuch a nice taſk, were to undertake it, I am confident that optics would make a grand ſtep of improvement by it, as opticians could eaſily determine what glaſſes might be properly made uſe of, either for magnifying or drawing near all kinds of objects, with reſpect to different eyes.

What may be the reaſon why the black tranſverſal line is perceived at once, but without diſtinction, and with a ſort of confuſion in the mind, when at the firſt place, or at a middle diſtance? To this I anſwer, that the rays emitted from the tranſverſal line, coming into the eye by different ways, and without intercepting each other from their ſeveral points of emiſſion to the eye, (according to the poſition of the globe and objects) cannot all, though admitted into the bottom of the globe, perform a complete ſenſation, as there can be but thoſe which are in proportion of the diameter of the pupil, and come by or in direct planes on the immediate organ of ſight; for though the oblique rays, which are more extant than the diameter of the pupil to that diſtance, enter

ter into the globe every way, and produce a weak ſenſation, nevertheleſs, they cannot take up reflection at the ſame time to complete viſion, like thoſe which are proportioned to the diameter of the pupil, and admitted in direct planes into the globe of the eye. The ſenſation being performed on ſeveral parts of the *retina*, by ſeveral objects at the ſame time, the reflection being ſucceſſive, cannot but confuſe at firſt; becauſe the reflection muſt preferably be taken up by the ſtrongeſt ſenſation, (which is undoubtedly produced by the direct rays that enter into the eye) than by that effected by a multitude of weak rays which come in the eye obliquely, and conſequently cannot equal it. I am going to explain the whole in the following paragraphs.

Demonſtration. Suppoſe (Tab. I. fig. 3.) a long perpendicular object Z X, from which are emitted ſeven horizontal rays cloſe together and equal; ſuppoſe the pupil equal to five of them in diameter, and the globe ſituated as in the figure, being a fixed diſtance; the rays 1 F, 7 G, cannot go parallelly into the bottom of the eye, becauſe they are intercepted by the iris to the points F G; but the rays 2 A, 3 B, 4 C, 5 D, 6 E, have the faculty of going in without being intercepted, if the eye be ſound. The central ray is tranſmitted from its emiſſion into the bottom of the globe, without undergoing the leaſt refraction. As for the other four, they deſcribe a parallel one, as they go from the central convexity of the cryſtalline: if its convexity be leſs or more on one ſide of the cryſtalline than on the other, the rays are refracted in proportion, *et vice verſa*.

After ſo clear an explanation, it is obvious to every body, that, to ſee the whole object without any motion of the globe, or object itſelf, it muſt be removed at a farther diſtance, in order its diameter be equal to that of the pupil; then there will be no difficulty of conceiving

ceiving the transmission of the seven rays into the bottom of the globe, according to the rules of confusion, in the points from which the rays are emitted, and which I shall demonstrate hereafter. If the globe, at the same distance, was to move perpendicularly downwards, of one ray only, the 1 F shall be introduced in the botton of the globe, and the 6 E, 7 G, shall be intercepted by the iris; of course, the ray 3 B shall become central, supposing always that no other rays interfere in our demonstration. For besides the seven horizontal rays emitted from the perpendicular line ZY, that come straight, and, as in a plane, to the globe, there are as many seven others which are emitted from the perpendicular line, as it is possible the object and eye itself may have positions, some of them being more or less inclined, according to the various positions of the eye, and those of the object.

Suppose the same globe in the same position as above, but an object forming a perpendicular line at the same distance from the eye; what can be the number of all possible rays, and their different effects, dependently or independently of each other, from their emission into the eye, as light propagates itself every way? I hope the following demonstration will make it intelligible, even to the meanest capacities. Let us suppose an object A B (Tab. I. fig. 2.) forming a perpendicular line, divided in twenty distances, which make one-and-twenty points, supposed closed to each other, so near as to admit of no distance ever so small, and that from these 21 points, 21 rays be emitted horizontally, as described by the figure; besides, let us suppose that the five central rays are equal in diameter to the pupil, and enter the globe in undergoing a proper refraction; it is very clear that the horizontal rays 1, 2, 3, 4, 5, 6, 7, 8, are intercepted by the globe, as well as the rays 14, 15, 16, 17,

18, 19, 20, 21; but the 9, 10, 11, 12, 13, being equal in diameter to the pupil, paſs into the bottom of the globe, make an impreſſion on the retina (together with all the other oblique rays emitted from the points 9, 10, 11, 12 13,) and produce a ſenſation: from thence a reflection enſues, which occaſions what we call the agreeable ſatisfaction of *ſeeing* what the object is, or may be, according to our notions of ſuch a part which comprehends five points; but as the whole line ſends forth as many poſſible rays as there is poſſibility of horizontal and oblique ones, let us now only demonſtrate thoſe that may be admitted into the bottom of the eye, to produce viſion, independently of thoſe that are intercepted by, or go out of the reach of the globe; then we ſhall next conſider how many rays this perpendicular line emits, either oblique or direct, at the ſame time, in different planes. I mean here, by the word *plane*, a bulk of rays taking all the ſame direction: For example, the 21 horizontal rays (Tab. I. fig. 2.) form a plane. The oblique rays 1, 2, 3, 4, 5, (Tab. I. fig. 1.) form an oblique plane, as well as the 17, 18, 19, 20, 21; which planes, united together, form a body, that I denominate by the appellation of *bulk of different planes of rays*.

Every point of the perpendicular line out of which the rays are emitted, ſending forth around as many as there are points in one circle, it is very eaſy to conceive, that five being the diameter of the pupil, none but five rays of all thoſe emitted from each point ſhall be admitted into the bottom of the globe: therefore, if we multiply five by five, the number of the pupil's diameter, we muſt conclude, that five-and-twenty rays of the perpendicular line are the only ones that are neceſſary to perform a complete viſion of ſuch a part of the object that comprehends five points, without any motion of the globe of the eye.

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This being understood, it remains now to demonstrate, how many rays emitted from the same line, tho' admitted into the bottom of the globe, have no effect upon the retina, as every point of the line sends several rays every way. If the one-and-twenty points send one-and-twenty circles of rays, and that the pupil's diameter be equal to five rays, let us multiply one-and-twenty by five, the number shall be one hundred and five; out of which take away five-and-twenty that perform the natural vision, eighty rays from the line shall be the number that have nothing to do in the execution of the sensation to operate it.

It follows, from what I have been demonstrating, that the planes of the 25 rays which operate the sensation, are transmitted into the globe from their emission, as they are described (Tab. I. fig. 7.) supposing no distance between all the rays, though I have been obliged to describe it so, to make it more sensible to the eye.

Moreover, as a circle of rays is emitted from every point (see the five rays emitted from the point 21 (Tab. I. fig. 2.) independently of the horizontal one, which cannot be admitted into the bottom of the globe) we must conceive a confusion of them; that is to say, that the rays run over each other through the same points of the pupil, and are transmitted and admitted in the bottom of the globe as in a direct plane or mass, except those that have nothing to do in performing a complete vision, as they go out, or are intercepted by the globe.

After such an explanation of the passage and interception of the rays, there is another object to consider, and which is of no small difficulty to account for: Every body's experience is a proof that the rays of light have such a penetrating power, that they pierce through the

eye-lids, and ſo are admitted into the bottom of the globe; but the ſenſation they produce upon the *retina* is very different from thoſe which are taken in without any objection; therefore the ſenſation of the rays of light is always in proportion to the thickneſs of the atmoſphere and objects that intercept them, before they arrive upon the immediate organ of ſight.

To be convinced of the penetrating power of the rays through the eye-lids, ſhut your eyes, and expoſe them to a very clear light; then paſs and repaſs any object very thick and impenetrable to the light, you ſhall diſtinguiſh the day or darkneſs, as it will be off or on; conſequently the rays which go through the eye-lids in the eye when ſhut, ſhall more eaſily paſs through the iris which is not ſo thick, and ſtill more through the pupil, and all the tranſparent humors of the eye. There is, beſides, another thing to infer from this, which is, that the rays of light may be hurtful to the immediate organ of ſight, when too ſtrong or powerful, if the humors, through which they go, are alſo too tranſparent. So that we muſt look upon the equilibrium of our eyes as a very delicate and well-regulated one, that ſhews plainly the work of the all wiſe Creator: therefore every body has a right to ſuppoſe, that when a phyſician knows perfectly well the mechaniſm and the natural ſtate of this beautiful organ, he may the eaſier remedy its deformities and diſorders.

But I muſt return to the further explanation of the emiſſion of the rays of light, how and in what manner objects emit them, according as they are diſtant from our eyes. To comprehend it better, let us enquire into the cauſe why the diſtance of the object makes its diameter leſs according to our eyes. When you look at an object of a given extent to a determined and known diſtance, you muſt always underſtand, that ſo many rays are

are emitted from it, if there are ſo many points, and that theſe receive a ſufficient degree of ſtrength from the primary light, either directly or indirectly, in order that the rays emitted from them may be ſtrong enough to operate a ſenſation upon the immediate organ of ſight; for in a given poſition of the object, we ought to conceive a certain number of them, which ſhall diminiſh or augment in proportion of the different diſtances; that is to ſay, that the number of the points from whence the rays ſhall emit, and which we will ſuppoſe ſeparated from each other, ſhall augment if you draw the object near the eye, and diminiſh if put back from its firſt place: becauſe, being put off at a greater diſtance, it is clear, that the reflection of light ſhall be effected on ſeveral points, inſtead of one as before, in order that a ray, being the confuſed emiſſion of ſo many at ſuch a nearer diſtance, be capable of producing ſenſation on the *retina;* for which reaſon, the object diminiſhes in appearance to our eyes as ſoon as it is put farther back, ſince two, three, or more points become but one at a leſs diſtance, from whence only one ray is emitted, able to produce a ſufficient ſhake on the immediate organ of ſight. From thence we muſt therefore conclude, that when an object is of a conſiderable extent and near our eyes, it is impoſſible we can ſee it entirely at the ſame time, without motions either of the globe of the eye or head, conſequently there can be admitted into the globe but a certain quantity of rays. We muſt alſo conclude, that the paſſage of the rays into the bottom of the globe, is always in proportion to the pupil's diameter and the object's diſtance, when a part of the object is perfectly ſeen.

Demonſtration. Let us ſuppoſe (Tab. 1. fig. 8.) an object *b.b.* repreſenting a perpendicular line, which comprehends only ſix points, from which ſix rays are emit-

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ted, the pupil I I being five in diameter; it is very clear, that the six rays but one, shall be transmitted into the bottom of the globe, and the object shall be seen and conceived at the same time, without any motion of the eye or head, in five points only. Let us suppose the same object removed back one equal distance more from the eye, the six points of the object shall be confounded in three; then the pupil's diameter shall be too large of two points, instead of being narrower of one at the first distance. This diminution makes the object appear but one half of what it was; because, the rays of light being less powerful when they reflect from a small point, must be multiplied in bigness, to correspond and be in proportion to the strength or sensibility of the immediate organ of sight.

The reason why we see objects of the same nature at given distances, when others are imperceptible to us, is very easily explained and conceived by this confusion of rays and diminution in their number. Let us suppose, that the pupil I (Tab. I. fig. 5.) be five lines in diameter, and the object M M twenty lines distant from the pupil; the third ray, whose diameter is equal to that of the pupil, being emitted from the middle of the object distant of four lines, shall be equally sensible to the immediate organ of sight, as five other objects, each of the same diameter and joined together, from which five rays shall be emitted at twenty lines distance from the pupil. To have a convincing proof of this fact, let us calculate the confusion of four inclined rays 1 Y, 2 Y, 4 Z, 5 Z; then we shall have an opportunity of remarking the exactness of our calculation of the several objects in AB, CD, EF, MM. If we compare the distance D*d* to that of M*b*, which describes the inclination and confusion of the rays, we shall see that the first is but one half of the second: If we compare the distance

ſtance Bb to that of Ff, we ſhall ſee that the firſt is but the third of the laſt, becauſe the objects are diſtant from the pupil one third leſs than the other; that is to ſay, that Bb is to Ff, what Dd is to Mb; from whence we may conclude, that an object of the ſame nature is equally ſeen at five lines diſtance, if it comprehends five lines in diameter, and the pupil as many; as this ſame object would be ſeen at twenty lines diſtance, if it comprehended five-and-twenty lines in extent, ſince the confuſion of the inclined rays is always in proportion to the diſtance and extent of the object from whence they are emitted.

But I ſhall obſerve here by the way, that two objects of the ſame extent, and at the ſame diſtances, but of a different nature, operate a great diſproportion in the diſtances, as a light of one inch in diameter may be ſeen from one end of the horizon to the other, when any other object of the ſame diameter, and at the ſame diſtance, ſhall be even inſenſible to the immediate organ of ſight at a hundred feet diſtance, ſuppoſing its quality not of a luminous one. There is alſo a very great difference when theſe objects are expoſed to a ſtronger or weaker light; becauſe the more an object receives of the particles of the primary light, by reflection or otherwiſe, the more it is able to emit of itſelf a greater quantity of ſtrong rays, according to its extent, quality, diſtance, *&c. &c.*

Let us return to our demonſtration. Suppoſe an object D D (Tab. I. fig. 6.) diſtant from the pupil of your eye O O of four given and known diſtances, but equal in diameter to the pupil, though at the furtheſt diſtance from it; what can be the number of points in your pupil's diameter that ſhall become empty; that is to ſay, through which no rays, emitted from the object, ſhall go into the bottom of your eyes? If you ſuppoſe the object

object D D equal in diameter to your pupil O O at the furtheſt diſtance, containing eighty points, which ſend 80 rays into your eye; when you will place the object D D in E E, there ſhall be forty points in your pupil, through which no rays are tranſmitted; and when placed in H H, ſixty; becauſe the object in this laſt place, though it contains eighty points from which eighty rays are emitted, is contracted in ſuch a manner that being nearer your eye, the points are multiplied, and produce, though ſmaller than they were before, a degree of light which is alſo multiplied in proportion, that ſhakes ſufficiently the immediate organ of ſight at ſuch a diſtance, as to operate ſimple and natural viſion.

We ſhould not wonder why, with both our eyes, we can ſee perfectly only one object at the ſame time, though each eye is ſuſceptible of receiving ſeparately the impreſſions of the rays of light. If we examine two objects at once, one placed at our left hand and the other at our right, we ſhall conceive an impoſſibility of fixing them ſeparately with each eye at the very ſame inſtant. But if, by a kind of violence, with the tip of one finger, we break the parallel axis of one eye only, we are immediately ſenſible of the ſenſations received diſtinctly in each eye, without being able of forming a perfect idea of each object at once; becauſe our eyes being accuſtomed to follow the ſame motions, that which is put out of its parallel axis is immediately hurt, and feels a greater ſenſation by it than by the impreſſions of the rays emitted from the object itſelf; conſequently the reflection muſt be employed about the touch of the finger, and not the rays coming from the object.

Beſides, as we cannot reflect at the ſame time about two different ſenſations, though felt in the ſame inſtant, as

as I have explained above; it is, besides, necessary it should be so for the help of each eye, and to save us from a continual confusion; because, if we admit that squinting eyes, as it happens, see at once two different objects with each eye, we cannot, by the same reason, grant two reflections without any sort of interval whatever. You have a power of staring at a multitude of objects at the same time; but you cannot reflect about them, and conceive a perfect idea of them, all at once, or in the same instant.

Having candidly laid down the principles on which the theory, and phenomena of vision are to be thoroughly acquired, I shall now proceed, by prying into the causes that have given ground to the different systems, and demonstrate, at the same time, what could be the reasons which led opticians to such great errors as those they have fallen into. Nothing is so obnoxious to physic, and the human sciences in general, as to lay down for truths of fact mere systems grounded on calculations, and geometrical demonstrations, when facts, and experiments able to ruin them, are wrapt up, disguised, and very expensive. This is still worse, when such systems are transmitted to us with an air of the firmest assurance, by truly eloquent, and sublime men, whose superior talents have acquired the approbation and admiration of their cotemporaries; it is, then, with all due respect to these great men that we ought to oppose the stream, keep up the imperceptible right of truth, and give an ample satisfaction concerning such facts, as the finest and most brilliant systems cannot maintain themselves. When we are once launched out in a false system, the most gratuitous cost nothing to defend it.

Mr Locke has given us a complete apprehension of our ideas and perceptions, in his Treatise upon the Human Understanding: therefore, if the sense of vision

must be compared and reasoned upon as that of touch, *in sensation*, it is clear, that all our greatest philosophers have not conceived and distinguished the effect from the cause. That any object is represented on the immediate organ of sight, or on any other surface, when its rays emitted from it pass through a convex glass placed at a hole in a window-shutter, is undeniable; but to conclude that it is seen and conceived from its being so represented, would be as absurd as to advance, that a dead eye should see just the same, since the picture is existing at the bottom of it, when its anterior tunics have been taken away. By what phœnomena then is this picture operated?

Make your room as dark as you can, perform a round hole of a quarter of an inch diameter in the shutter, opposite the top of some houses upon which the funnel of one or two chimnies are to be easily espied, present a white sheet of paper one foot and a half distant from the hole; then you will have an opportunity of observing, that the top of the opposite houses are described inverted, and that the images of all the anterior objects are also represented, upon the sheet of paper, just of the same color as they really are: As an addition to the experiment, oppose a lens whose focus be six inches, at two inches inwards from the hole practised at the shutter, the sheet of white paper placed as it was before; then you shall see the pictures of the exterior objects painted upon it a great deal more clear, than you was able without it; and if you place another lens, whose focus be but three inches, at three inches distant from and with the first, you shall certainly see the pictures of the objects still clearer, than you did with one lens only.

All the objects (as I have already observed) which surround the hole, emit as many circles of rays as there are points contained on their surfaces, that are suscepti-

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bles of painting their ſeveral colors on the paper, which we will conſider here as a point of abſorption. If, in purſuing our enquiry, we look for the difference in the nature of the rays which are admitted to paſs through the hole, and diſtinguiſh the number, either of direct or oblique, in order of acquiring which of them produce more painting; we ſhall undoubtedly find, that the number of oblique rays ſurpaſs that of the direct ones; conſequently if, of all theſe rays, the firſt ſurpaſs in number the quantity of the laſt, it muſt neceſſarily follow, as the rays paint the images, that the pictures of the objects be inverted, as there are a greater number of theſe to operate painting. If, on the contrary, the direct rays were to ſurpaſs in number the oblique ones, the pictures of the ſaid objects ſhould certainly be repreſented on the paper as they naturally appear. Suppoſe now, as I am ſure it does, that our organ receives the inverted picture of the object in its bottom; do you, or can you conceive, that the rays which produce this inverted picture, produce alſo a ſenſation of the object inverted? No, certainly; for were it ſo, we muſt neceſſarily conclude from thence, that one might ſee the object inverted, what does not exiſt in the leaſt, unleſs it be in the imagination of thoſe builders of abſurd ſyſtems. If philoſophers are fond of making hypotheſes, their diſciples are as zealous to defend them. The honour of a whole ſect is thought to be engaged, and every individual is piqued that another ſhould ſhew that to be falſe which he has, all his life, taken to be true: ſo that, notwithſtanding all the graces of novelty, a new truth will have much to do to diſlodge an old error. Inſtances of this ſort are innumerable. Is it reaſonable, when we cannot draw, from obſervation and experiment, ſuch concluſions as may be ſafe foundations on

which to proceed by a juſt method, in the purſuit of truth, to aſſume certain principles, as if they were founded on the analytic method, which have never been proved, nor perhaps ſuggeſted, by the phenomena, in hopes that they may be ſo afterwards? In a word, when the only cue we have fails us, which is moſt reaſonable, to ſtop ſhort or to puſh forwards, without any cue at all, into a labyrinth of nature? I make no ſcruple of deciding in a caſe ſo plain, that it would be a ſilly affectation of modeſty to heſitate. When the phænomena do not point out to us any ſufficient reaſon why and how a thing is as we diſcover it to be, nor the efficient cauſe of it, there is a ſufficient reaſon for ſtopping ſhort and confeſſing our ignorance; but none for ſeeking out of the phenomena, this reaſon and this cauſe, which we cannot find in them. This is learned ignorance, of which the greateſt philoſophers have no reaſon to be aſhamed.

But to return: The hole, practiſed at the window-ſhutter as deſcribed in the above paragraph, being neither ſuſceptible of contraction nor dilatation, the rays emitted from the objects ought to be the ſame in number; therefore an alteration in the pictures, ſuppoſing *things* keep their place, cannot exiſt, though light be ſucceſſively ſtrong or weak. Wherefore is it poſſible for any man, who is perfectly aquainted with the anatomy and phyſiology of the human eye, to form a compariſon between it, and the *camera obſcura*, without being taxed of a ſyſtematical genius, eſpecially when a clear experience is naturally againſt it? In a *camera obſcura*, the place of abſorption is without any variation with regard to the effect; the *retina*, on the contrary, being ſituated on the choroides, which membrane is tinctured with *meconium*, is the place of abſorption in the human eye. What a difference! If the objects are expoſed to

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a ſtrong light, their pictures are ſeen in proportion on the place of abſorption in the *camera obſcura;* but as the rays are conſtantly the ſame in number, ſo the images keep to their magnitude and appearance: on the contrary, when the objects emit ſuch a pencil of ſtrong rays, the impreſſion they operate on the immediate organ of ſight is ſuch, that the circular fibres of the iris enter immediately in a motion of extenſion, which produces a contraction in the pupil; then you eaſily conceive, that the ſame number of rays, emitted from the objects, are not admitted into the globe, what diminiſhes of courſe the ſenſation, without any alteration in the reflection. How nice is ſo admirable a mechaniſm! Is not ſuch a fact, ſupported by experience and obſervation, ſufficient to ruin all the ſyſtems of our preſent opticians?

Let us puſh on our enquiry ſtill further: That an image or picture of an object which ſends rays on the place of abſorption, is equally perceivable in the *camera obſcura*, as it is into the bottom of the human eye, is undeniable: but to advance that this very image or picture of an object is the conveyance of the idea we form of it in our minds, is an abſurdity that I cannot ſubmit to. When we compare the formation of the picture on the place of abſorption in the *camera obſcura* with that on the immediate organ of ſight, we underſtand plainly enough, that in this light they are equally the ſame: But when we examine the effects on both, we muſt perceive a vaſt difference, as one is capable of feeling, and the other totally deprived of it; conſequently the ſenſation produced on the immediate organ of ſight comes from the ſhock of the rays upon it, as ſoon as they are abſorbed by the *meconium*. This very ſhock then cauſes a vibration in the neighbouring and contiguous nerves, which communicate their ſenſa-

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tion to the musculous fibres of the iris; then a contraction in the pupil takes place; the shock ceasing or diminishing by degrees, the action of communication yields in proportion, and dilatation gradually takes place. Besides another impossibility of producing a sensation might also happen, though the picture of the object be represented into the bottom of the globe, if the retina, or optic nerve itself, were hurt by any pressure, or afflicted by any disorder whatsoever. To conclude, I may certainly advance, that the shock produced by the absorption of the rays on the immediate organ of sight, performs sensation, and not the picture of the object on the retina, as has been advanced by philosophers, physicians, and opticians

If the retina be yellow, the objects, say they, ought to appear so too, because their pictures being represented upon it, convey this sensation to the mind, though the objects might be red, green, or of any other color. This is the kind of assertion you meet with in the best authors in physic and optics upon that head. Having demonstrated above, that the picture of the object on the retina does not produce the sensation, it would be needless to bring any other proof against it, were it not conducive of enlightening and instructing the reader. In order to do it more effectually, I will lay down the following experiment. Perform one hole of two inches diameter in a shutter, and make the room as dark as you can; place outwards a white discernible object of the same diameter, at three feet distance from the hole, and look at it with attention. If you are in perfect health, you shall certainly see it white; but if you place at the said hole, a flat yellow glass, and look at the white object through it, you shall perceive it of the color of the glass. What is the reason? To this I answer, that the rays emitted from the white object at first, being always

always the ſame, the ſenſation muſt be ſo too; but if you change their color by the interception of a yellow glaſs, the rays ſuſceptible of aſſuming immediately the color of the bodies they go through, it is natural that the ſenſation they produce be the very ſame, as they are laſt admitted into the bottom of the globe. You ought to look upon the cornea in this experiment, when a perſon is afflicted with the jaundice, as the yellow glaſs at the hole of the ſhutter; becauſe this diſorder being occaſioned by ſome caſſeous concretions, which, obſtructing the *duodenum*, from an obſtacle to the flux of the bile, are compelled, by this means, to reflux in the blood and lymph: and as the cornea of the Human Eye is made up of pellicles ramificated with lymphatic arteries, it is clear, that the fluid contained in theſe little veſſels give a tincture to the whole body of the cornea; therefore the yellow appearance of the objects in the jaundice, is only, or at leaſt more dependent, on the ſtate of this laſt membrane, than upon the immediate organ of ſight.

If phyſicians and opticians had conſulted the ſtate of their own natural viſion, which can alone afford means of acquiring knowledge concerning ſo curious an organ, inſtead of harkening to ſuch idle traditions, and raiſing chemeras of their own upon thoſe of other men; if they had proceeded, in the analytic method, from particulars to generals, as far and no farther, it ſeems to me, that they could ſcarce have imagined the *impreſſion* produced by the rays on the immediate organ of ſight, abſolutely diſtinct from that of the air on the auditive nerves. When you paſs from a dark room to a well lighted one, you cannot, for ſome time, ſee clearly the objects it contains; and, if you leave this laſt room, as ſoon as your eyes are accommodated to the degree of light, to come back to the firſt, you ought

ought to have generally experienced, that you are not able to discern any object at all for a considerable time. In what manner ought we to account for this fact? If you pass from a dark room into a well lighted one, all the objects which surround you, send immediately such a quantity of strong rays on the retina, that your reflection is quite taken away by their too violent impression; because, the fibres of the iris not being so quick in their action to operate a motion of extension, which produces a contraction, as the introduction of the rays into the globe, the too great quantity of these rays cannot be intercepted in time, to become in proportion to the sensibility of the immediate organs of sight: If, on the contrary, you pass from a well lighted room into a dark one, the contraction in the pupils, necessary to moderate the strength of the rays, when in the first room, operates such an interception of them at the time you arrive in the second, that the number is not sufficient to operate a sensation on the retina, as they are emitted from objects which receive themselves no sufficient power from the primary light; because you are obliged to stay a long time in the dark room, to give the fibres of the iris a proper time of operating a dilatation, in order to admit a sufficient quantity of rays on the immediate organ of sight, capable of producing a sensation upon it. There are some eyes, I know, whose pupils are more susceptible of contraction and dilatation than others; but this must be out of the general rules I am now speaking of. If, now, we are to form a conclusion from all these observations, without any further reasoning about them than such as they justify, what must it be?— It must be plainly this, that there is in the whole animal kind one intelligent spring, common to every species, but vastly distinguished in its effects; that tho' it

it appears to be the ſame ſpring in all, yet it ſeems to be differently tempered, and to have more elaſticity and force in ſome, and leſs in others; and that beſides this, the apparent difference in the conſtitutions and organizations of men, ſeems to account for the different determinations of the viſual powers, and the ſurpriſing variety of its effect.

If there were any poſſibility to aſcertain the refractive power of the human eye, the ſenſibility of the *retina*, the elaſticity of the fibres of the iris, and the thickneſs of the *cornea*, I could give a ſatisfactory account of all the different ſights men are in general provided with: but I candidly confeſs my doubts, therefore I ſhall not pretend to trouble the reader, as ſome writers have. However, before I put an end to this part of my treatiſe, I will ſay one word or two on the effects of ſpectacles, or glaſſes on the eyes. It is a very nice caſe, if a phyſician has ſix objects to combine together, when he looks for the cauſe of the defects in the ſight. The variation of elaſticity in the fibres of the iris, abſtractedly conſidered, may be, in ſome meaſure accounted for, eſpecially if you make the following experiment, upon the eyes of a perſon well conſtituted and in perfect health. Let the perſon be ſeated motionleſs before a window, when the light is continually and uniformly the ſame; put a pair of ſpectacles forty-eight inches *focus* upon his noſe; examine with the ſtricteſt attention, if by putting them on and off, the pupils contract and dilate. This done, repeat the ſame experiment with ſeveral ſpectacles of known *focus*, ſuch as 24, 12, 6, and even 3 inches; what ſhall be the reſult? The dilatation in the pupils ſhall augment with the focus, becauſe the thicker a glaſs is, and of courſe ſhort focus, the more the rays of light, which go through it before they arrive on the retina, are intercepted; conſequently an inſufficient

ſenſation, not operating a motion of extenſion in the fibres of the iris capable to perform a contraction, the dilatation muſt take place. The change of the ſpectacles for the ſame experiment, will always produce a variation of dilatation in the pupils of different mens eyes, as it is impoſſible to meet with two men, whoſe conſtitutions are the ſame in every particular. Such experiments will give you an opportunity of diſtinguiſhing the dilatative and contractive powers of the pupils, the ſtiffneſs and elaſticity of the fibres in the iris.

It would be now a proper place to ſpeak of the effect of ſpectacles on the ſight; but as this ſubject belongs to the optician, I ſhall not encroach here upon his right. Beſides, to avoid repetitions, I will not ſpeak any more about the effects of the rays on the immediate organ of ſight, and the change that happens in the fibres of the iris, it being facts which are obvious to every capacity, after what has been ſaid concerning this ſubject.

Some phyſicians and philoſophers have advanced, that the cryſtalline had a motion of forwardneſs and backwardneſs, if I may be allowed the expreſſion, to facilitate the refraction of the rays of light, and receive them as ſoon as they enter the globe. Comparative anatomy and phyſiology are of very great uſe to us in this conjecture. I have mentioned in the anatomical deſcription, that the cryſtalline lens is placed in a foſſula at the anterior part of the vitreous humor, and kept faſt by the proceſſus ciliaris, conſequently, I look upon the above aſſertion as groundleſs.

The cryſtalline lens of quadrupeds and ſuch as have the membrana nictitans, do not preſent us with the ſame anatomical ſtructure and phyſiology as the human eye, therefore no compariſon can be properly made between them. The moſt perfect eye in the creation is, I believe, the cat's eye, and other animals of his kind. The

ſclerotica

ſclerotica is exceſſively thin, but it is ſtrengthened by the aponeuroſis of nine muſcles, whereof ſeven of them ſurround the lateral parts of the globe, and end at the cornea. The cornea comprehends almoſt one half of the globe, and is much more tranſparent and of a cloſer texture than that of a man. The cat's iris does not divide the anterior part of the eye into two chambers, but is placed immediately and looſe, except at the edges, on the anterior part of the vitreous and cryſtalline humors: its pupil is vertical and does not dilate and contract according to the laws of that of man, the texture being different, and having neither longitudinal nor circular fibres; but it dilates and contracts by a projection and retraction of the vitreous humor and cryſtalline lens, which motion is operated at will, by the three poſterior muſcles. The retina is more nervous, and overſpread by a greater quantity of arterial branches than that of man; beſides a greater quantity of viſual arteries vivify the optic nerve, which render it more ſenſible of communicative powers. Conſequently we can eaſily account why and how the cat ſees by night and day, and preſerves his ſight unhurt, though he frequently paſſes from a dark place to a light one, *et vice verſa*. The membrana nictitans is the preſervator of the cat's eye in two reſpects; in one, becauſe that part which comes immediately in contact with the external parts of the globe, is ſmooth and furniſhed at its extremity, with nine glands, continually ſupplied with a ſebaceous humor, to temper the acrimony of the tears, and keep the cornea in its natural tranſparency. If the cat goes from a dark place to the ſun-ſhine, his ſudden faculty of contracting the pupil not being ſufficient, the membrana nictitans and the lids come immediately to intercept the rays,—a function that we generally ſupply by the uſe of our hands on our eyes ſhut. From what has been

advanced, it will evidently appear, that obſervators, who thought that there was a motion of forwardneſs and backwardneſs of the cryſtalline lens to anſwer ſome purpoſes in the ſight of man, ought not to be depended upon. Mr Locke, who was the proper writer to conſult upon the ſubject, has been the only one that has not been mentioned by them all. When authors have been ſufficiently ſenſible, that it was impoſſible to detect them in hazarded opinions they have ventured all ſorts of ſyſtems. Thus have they in all ages amuſed mankind with ſyſtems of imaginary knowledge, raiſed in fantaſtical ideas and notions, rather than confine themſelves within the limits of real knowledge. Inſtead of mixing our opinions by evident truth, and giving our minds any ſolid foundation whereon to reſt, they have involved us in doubts, and eternized diſputes.— Like *Noctambules*, they have ſtaggered about, and joſtled one another in their dreams. Since the torch of experimental philoſophy has been lighted up, theſe hypothetical reaſoning have been exploded, or elſe confined under certain conditions, in all that relates to corporeal nature.

After all theſe reflections and obſervations which I have laid before the reader, merely to deter him from the reading of ſuch writers, as they occurred to my experience, nay, after all thoſe which ſome others ſuggeſt, or which a man of better parts, more knowledge, and more leiſure, would be able to make, I doubt not but one of our moſt precious ſenſes will be better underſtood.

OF

OF THE

DISORDERS OF THE EYES

IN GENERAL.

IT is as eaſy to diſtinguiſh, by looking at the eye with attention, if it be deprived or not of the faculty of ſeeing, as it is difficult to know the true cauſe. The want of contraction and dilatation in the pupil, foretels a privation of ſight, whoſe cauſes may be numerous and diverſified. It happens, however, that contraction and dilatation exiſt, though the organ be deprived of ſight; but it is eaſy to diſcern one and the other caſe. The immediate organ of ſight is the only part of the human body, delicate enough to be ſenſible to the impreſſions of the weakeſt rays of light; therefore, the more rays there are united, and abſorbed on the retina, by the meconium which lines the choroides, the completer the ſenſation, otherwiſe this laſt operation does not exiſt, as well as reflection, which both contribute, dependently of each other, to make us perceive. If the rays arrive and are abſorbed on the retina, the ſtroke it receives is ſufficient to agitate the fibres of the iris; then a contraction in the pupil is operated. If the ſtroke become leſs, the fibres return in their natural ſtate, what operates conſequently a dilatation. The inquiſitive obſervers will remark this contraction and dilatation augment or diminiſh, exactly in proportion to the coruſcations of light; and if the rays arrive on the

the retina, without being abſorbed there, they paſs on the choroides, without producing a ſufficient ſhake to put the fibres of the iris in a regular motion; inſomuch that the pupil contracts and dilates by fluctuation,—a ſymptom which gives to underſtand, that the veſſels ramificating in the choroides, have no longer their natural elaſticity to keep the meconium upon its ſurface, in order to facilitate the abſorption of the rays on the retina; or, in ſhort, that this membrane is inflamed or unable to perform its functions by any cauſe whatſover. This malady is no leſs common than dangerous. It is no ſooner arrived to its laſt period, then it is deemed incurable, and characteriſed of a gutta ſerena, what ſhould not be, as this is liable to lead practitioners aſtray. So that it is very eaſy to conceive how many times this miſtake did, and ſtill does, furniſh occaſions of quackery, if you take upon yourſelf the trouble of examining the conduct of the artful writers and practitioners upon the diſorders of the eyes, either in their writings or practice. It is from their ignorance and cheat, that ſo many miſuſes have aroſe, and ſtill exiſt; in fact, they have characteriſed of gutta ſerena every privation of ſight, when the globe of the eye was not exteriorly affected, except that of the cataract and glaucoma, which have been ſince diſtinguiſhed.

The gutta ſerena is either perfect or imperfect. The paralyſis of the retina and optic nerve, more or leſs confirmed, conſtitutes one and the other. Menſes and hemorrhoides ſuppreſſed, blows on the head, apoplexy, overflowing of the milk, morphews kept in, ſcorbutic virus, venereal relics, &c.; obſtructions, ſanguinous and lymphatic tumors or others, either in the interior of the globe of the eye, or around the optic nerve, known by the opening of dead bodies, are capable to produce blindneſs. The perfect or imperfect paralyſis in the retina

tina and optic nerve occaſions more or leſs ſenſibility in them. Of all the ſymptoms that foretell a diſorder of the retina or optic nerve, there are none ſurer than the ſtate and motion of the pupil; becauſe after, having obſerved, that nothing intercepts the rays, and that they are abſorbed upon the immediate organ of ſight, there may be no other ſymptom to lead in a miſtake. If a *meconiumleſs* exiſts, the bottom of the globe of the eye looks grey, or of a very clear water color. The only caſe which obliges us to conjecture is, when the meconium is of a grey color; becauſe we cannot poſitively ſay if this blindneſs is occaſioned for want of meconium, or by an affection in the optic nerve: we may, however, get information from the patient's diſcourſes, and the different progreſs of the diſorder. All this depends very much on the ſkill and penetration of an able man, eſpecially if he has himſelf keen eyes. It is phyſically impoſſible to cure a gutta ſerena, conſidering the difficulty there is of diſobliterating ſuch ſmall veſſels, placed into the bottom of the globe of the eye; eſpecially when the obſtructions are old, or the internal membranes tore to pieces.

If the imperfect paralyſis of the retina is the conſequence of ſome lymphatic obſtructions in the veſſels which ramificate it, cauſed by a thickening in the humors, bleeding cannot bring to circulation all the coagulated humors that are contained in the extremities of ſuch delicate and ſmall veſſels, whoſe diameters diminiſh in proportion to their length; becauſe the ſwiftneſs of the evacuation is in compounded *ratio* of theſe veſſels diameter and fluids coagulation, and that a contraction muſt neceſſarily happen and ſtop up theſe humors in the extremities of theſe tubes, whoſe diameter is ſmaller there than at their ſource: conſequently bleeding ſhall only deſobliterate the humors in a limpid ſtate. Phy-

ſic,

ſic, in ſuch a caſe, indicates an emollient fumigation for external remedies, and diluting drinks for internals, whoſe end is to keep open the pores of the membranes of the eye, and facilitate the reſolution of the local ſtagnation. The effect, though ſlow, is however very ſure of ſucceſs, when every particular incident is attended to with the greateſt preciſion and ſkill. The ſight, after the uſe of ſuch external applications, becomes generally very dim; but, to counterbalance this defect of ſight, which is occaſioned by a relaxation in the parts, you recommend ſpirituous or aſtringent lotions, or evaporations of ſuch ſtrong ſpirituous fluids over the eyes as may well anſwer your purpoſe according to circumſtances. I give a complete explanation of the effect of theſe external remedies in the following obſervations, therefore I need not mention it here.

When the optic nerve is preſſed in the bottom of the ſocket by ſome tumors or other accident, whoſe conſequences are more important than the diſorder to which you will remedy, that caſe ought be excepted from the general rule. It is as impoſſible to cure the complete paralyſis in the retina, as the gutta ſerena; every phyſician who boaſts of ſucceſs in theſe two caſes, is a down right empiric, or ignorant of the real caſe.

The glaucoma is an opacity of the vitreous body, which becomes afterwards of a green color. Let us diſtinguiſh the ſpecies and cauſes of this pernicious malady, which every able phyſician deems incurable; in order that it may not be miſtaken for a paralyſis in the retina, an affection in the optic nerve, or a want of meconium on the choroides. The veſſels, which, from the choroides, paſs to the retina, and from thence into the vitreous body, to furniſh it with the nouriſhing juices ſo neceſſary to keep up its perfect ſtate of fullneſs and tranſparency, are liable to be obſtructed or ruptured

after

after ſome internal inflammations. By theſe accidents, the vitreous humor becomes tarniſhed for want of receiving its nutrition, and is not a long while to change this ſtate for that of the opacity, which then intercepts all the rays of light. Are not the pores in its capſule ſuſceptible to be obſtructed? Cannot an abſceſs be fixed on the poſterior part of this capſule, and produce there an opaque cicatrice, without any loſs of tranſparency in the humors, in the above two caſes? Moſt certainly: Becauſe the blood veſſels continue, in ſpite of theſe accidents, to bring in their fluid. If the whole part of the hyaloida, which is placed on the retina, became opaque, or the veſſels which ramificate it, only obſtructed, and that the vitreous humors and the anterior part of its capſule were tranſparent, would it not be very eaſy to miſtake this caſe for a gutta ſerena, if but a ſuperficial examination of the eye was made, or if the obſervator's eyes were not exceeding keen and good? Very likely. It is the very ſame miſtake of the contraction and dilatation in the pupil that have given reaſon to ſome antient and modern writers to ſay, that it was ſometimes ſuſceptible of it in the gutta ſerena: an error that brought a great many others after it. If we enquire into the cauſe of ſuch a contraction and dilatation in the pupil (the organ being deprived of ſeeing) we muſt be ſenſible that the hyaloida, being become opaque, or obſtructed in its pores to its poſterior part only, that it does not intercept entirely the rays of light which penetrate, for all that, on the retina, but whoſe impreſſions are not ſtrong enough to produce a ſufficient ſenſation to effect perception. When the vitreous humor begins to tarniſh immediately at the point the rays of light paſs to arrive on the retina, the pupil is dilated by degrees to let them go in; and when it is entirely dilated, and remains ſo, you may rather conclude, that this is a

symptom by which the glaucoma began. One or several cells of the vitreous body may also become opaque, together with the internal tunic, called arachnoida, without the whole becomes so too. These different causes constitute the more or less perfect glaucoma, and diversify it either in dry or humid. Internal or external inflammations, very ill attended to during their existence, are sources of the glaucoma.

There is another disorder which belongs particularly to the vitreous body, and would be difficult to understand, if I did not begin the description by its symptoms. I have often seen patients who complained of a pain at the anterior part of the head, and in the eye, some on one side only, and others on both: After that pain, which subsided in some, and in others continued, the globe of the eye, on the side of the pain, did appear a little bigger and more prominent, the pupil more dilated than ordinary, contracting but very little, and difficultly to a great light, and even to the sun-shine; besides, the sight did diminish so quick, that, in a short time, they could hardly distinguish the light, and very obscurely, common objects; some not being able to find their way, in a few days, without a guide. In most of those patients, the above accidents happened to both eyes, either at the same time, or some time after. To some, the pains which preceded the dimness were not considerable, feeling only some heaviness at the part; in others, they were sometimes so violent that I could hardly remark, whether the eye was in its natural state, or more prominent than ordinary, particularly with those who had naturally dark eyes; but with those who had grey, or large blue eyes, and who had only one eye disordered, I could distinctly observe, that the eye was bigger. In short, by the use of remedies which I shall mention hereafter, these symptoms did

did diminiſh by degrees, and the patients recovered their ſight, ſome ſlowly, others ſuddenly; but moſt part a while after, except thoſe who did not go through the ſame remedies, the diſorder terminating always in an incurable glaucoma.

Reflecting on all theſe ſymptoms, I think that the globe of the eye cannot acquire a bigger ſize, unleſs ſome humor gather within itſelf; and, if that happen to be the caſe, the vitreous body muſt indeed be increaſed, and the pupil unable to dilate and contract freely; therefore, I have every reaſon to believe the increaſe only partial in the vitreous humor, and particularly in the above caſe. If you recollect what I have ſaid concerning the ſtructure and nutrition of that body in the Anatomical Expoſition, it will be eaſy to conceive a kind of contraction and dilatation in the pupil; ſince the aqueous humor being abundantly ſupplied, it muſt be equally diſtributed in both chambers, conſequently the iris cannot be more preſſed on the one ſide than on the other. If the vitreous humor is viſcous, and ſtagnates in its capſules, the vitreous body will increaſe in ſize; and that cannot take place, unleſs the following ſyptoms appear: *Primo*, The globe of the eye ought to be a little bigger, ſince the vitreous body in its natural ſtate takes up moſt part of it. *Secundo*, The cornea ought to be more prominent, becauſe the aqueous humor is violently puſhed forward. *Tertio*, Patients ought to feel pains in the eye at the beginning and progreſs of the diſorder, on account of the extenſion of the membranes of the globe and thoſe contained in it, and by ſympathy to the anterior parts of the head. *Quarto*, The pupil ought to be dilated and almoſt immoveable, becauſe the vitreous body in extending, brings the cryſtalline lens forward, and preſſes on the poſterior part of the iris. *Quinto*, The ſight ought to diminſh

excessively, because the refractions of the rays of light are altered on account of a change of situation of the crystalline lens, and the retina pressed backwards by the vitreous body. *Sexto*, When this body returns to its natural size, sight comes on again but not so perfect as it was before, for such an alteration cannot take place without some slight disorders remain in the other parts of the globe of the eye.

The disorder in its begining is very difficult to distinguish from the true cataract, the symptoms of both being nearly alike; but as its progress is afterwards quicker, without any appearance of alteration in the crystalline lens, we become sure of its kind in due time. Men of a cacochimic and melancholic constitution are commonly afflicted with that disorder, but those who are most subject to it are women with child who come within the above constitution. The disorder begins about the second month, and continues till they are brought to bed, or often long after it; also to women who have not their courses, or have them irregularly. Practitioners mistake this disorder for the gutta serena, because no other alteration of the eye takes place, except a great dilatation in the pupil. It is sometimes cured when the eyes are blue, but seldom when they are dark, because the coats and tunics of the former are soft and more porous than the latter.

The disorders of the crystalline are few in number, but very well known. Physicians are only divided in their opinions as to its nutrition. Some pretend that this lenticular body keeps its transparency by the help of the nourishing juices brought by some blood vessels, which penetrate from the capsule of the vitreous body in the crystalloida; others that it is by imbibition, as it swims in Morgani's humor. Without being able to satisfy and convince every body by any physical reasons

whatever,

whatever, to the ſupport of one opinion more than of another, (as theſe veſſels are almoſt inviſibles, and that the cryſtalline, which is a ſolid body, cannot of courſe ſoak a great quantity of morgani's humor to keep it tranſparent) I think that both means contribute to preſerve its perfect tranſparency. The alteration of the cryſtalline, called cataract, is the moſt common diſorder of this diaphanous body. The ſurer method to cure it is extraction: when the capſule, which wraps it up, becomes opaque, we call it *membraneous cataract*, though the cryſtalline lens be tranſparent. If it be ſtony, *ſtony cataract*, and ſo on of all the other forms or ſpecies it may aſſume; but when ſeveral of theſe diſorders meet together, it is called *complicated cataract*. The moſt common ſymptoms are a dimneſs in the ſight, though the pupil dilates and contracts, when the organ is expoſed to a leſs or greater degree of light; ſome flies, filaments, and many other objects, the patients fancy to ſee flying before their eyes, whoſe forms vary in proportion to the ſpots which are exiſting in the cryſtalline, or on the cryſtalloida. The different treatments change the ſymptoms according to the alteration of the diſorder, its periodical cauſes, and the patient's health, as ſhall be explained at large in the following obſervations on this head. If the cataract be formed by want of circulation in the humors, which is very often the caſe, the remedies, which are conducive to promote it, ſhall be the propereſt indications; but great precautions, ſkill and experience are required, in order to chuſe them right; for ſome of them may be very dangerous, as they occaſion a running of meconium from off the choroides. All this depends very much on the particular care of the phyſician. The preſcriptions of internal medecines, in ſuch a caſe, are ſeldom of uſe. They, indeed, can retard the formation of the cataracts; but I have obſerved, that, in general, they are formed

in

in ſpite of the ſtricteſt attendance. This diſorder cannot be diſtinguiſhed but by thoſe who have a great deal of experience and ſkill, and exceeding good eyes.

The iris is ſuſceptible of inflammation, as well as all the other parts which compoſe the globe of the eye. When it is only fixed on its anterior lamina, it looks of a reddiſh color; and on its poſterior, you can but conjecture it by the pains the patient ſuffers. The manner of curing this diſorder will be laid down in the following obſervations. When the inflammation is properly attended, no defect remains on the iris; but if a ſuppuration takes place, the abſceſs generally opens of itſelf, and its matter empties into the globe, without any detriment to the other parts. I ought to obſerve by the way, that on the abſceſs's place, a whitiſh or blackiſh ſpot, called cicatrice, is the never failing conſequence. If the abſceſs be conſiderable, and the matter acrimonious, it very often ends with the dejection of all the other internal parts of the globe of the eye, or at leaſt ſome of them.

The Hypopion is a gathering of corrupted matter, which continues for ſome time within the coats of the eye, particularly in the cornea, and afterwards evacuates either within the chambers of the eye, or out of the globe. This gathering may be produced by an abſceſs or extravaſated blood, occaſioned by a blow or a violent inflammation, the ſmall-pox, extraction of the cryſtalline, &c. There are a great many methods of proceeding in the cure of this diſeaſe: firſt, it is abſolutely neceſſary and important to be well aſſured of the cauſe. This gathering of matter may be evacuated if it be fluid, by the uſe of warm emollient lotions or fumigations; ſometimes bleeding will be neceſſary at the ſame time, if poſitively the violence of the inflammation requires it. If you do not ſucceed, and that the matter

matter be ſolid and acrimonious ſo as to endanger the loſs of the organ, you ſhould open the cornea to let it out.

The diſorders of the cornea are very common. The albugo and ſpots which grow on this membrane are produced by inflammations very ill attended to. The obſtruction in the veſſels of the cornea are the very cauſes of this diſorder, as they deſtroy its tranſparency. After a violent inflammation in the eye, inflammatory puſtles, ſuch as very often happen on the cornea by ſeveral cauſes, and eſpecially during or after the ſmall-pox, are alſo conducive to it. The little ſcars made after the reſolution of an abſceſs, and the cure of a wound in the eye; the action of ſharp or corrodent remedies fallen by chance on the globe of the eye, or ignorantly applied on; in ſhort, the abſceſſes, or gathering of humors, which are formed during or after the inflammation, even betwixt the *cornea's laminæ*, when theſe humors become hard by degrees, form almoſt always the opacity. The albugos, and ſpots in and on the cornea, are always of a very difficult cure; but all do not oppoſe the ſame reſiſtance. They are more or leſs eaſy to cure, in proportion to their extent and ſituation in the external or internal *laminæ*.

The Pterygium is a riſing, fleſhy membrane, which begins growing to one or the other angle of the eye, and extends ſlowly from the conjunctiva to the cornea, to ſuch an extent, as ſometimes to intercept entirely, or in ſome part, the rays of light. It is very often formed on the conjunctiva, and ſometimes betwixt this membrane and the albuginea. People accuſtomed to periodical and habitual inflammations in their eyes are the moſt ſubject to this diſorder. The varicous veſſels occaſion a diſcharge of nouriſhing juices, which find their flowing intercepted between the interſtices of the

membrane,

membrane, and become by degrees ſolid in producing ſome excreſcences, which vary in color and ſize. The pterygium, as well as an infinity of tumors, which grow under the eye-lids, may be extracted without the leaſt danger to the organ ; and when the patient will not undergo the operation, they may be deſtroyed with the uſe of deterſive pomatums, as are recommended in the following obſervations.

The Staphyloma is a tumor produced by a membrane puſhed out of the globe by the humors of the eye. For example, the ſtaphyloma of the iris is ſo called becauſe part of it appears without the globe, through a hole, either in the cornea, ſclerotica, or between one or the other of theſe membranes. The ſtaphyloma of the ſclerotica and cornea are ſo called, when one or the other of theſe membranes become thinner in one place than in the whole extent, and are dilated by degrees, ſo as to form a more or leſs conſiderable tumor over their natural convexity. The prognoſtic of theſe diſorders is always unfortunate : for, beſides the loſs of ſight, and extreme deformity they occaſion to the eye, they often produce head-aches, wakes, very violent and ſevere inflammations, ſuppurations ; and it is not even very rare, if they degenerate into a cancer.——Great attention to the ſize, cauſes, and patient's health, during the treatment of this dangerous diſorder, ought to be attended to.

The eye-lids, which adhere to each other, or to the globe of the eye, either naturally or by diſorders, by what cauſe ſoever, are ſo uncommon caſes, that we meet with obſervations upon them in authors, except their uniting by a glutinous matter, which flows very often in the ſmall-pox ; but this is very light and ſuperficial, as it cannot be looked upon as a true coaliſion. This deformity is ſometimes to be met with in infants.

infants. The cure consists chiefly by separating with dexterity one eye-lid from the other, and taking proper means to palliate the violence of the inflammation, that such an operation must necessarily occasion. All this depends upon the skilful operator, who must take into consideration what may be the most proper means, in order of disuniting the eye-lids the better, and destroy their adherence from the globe, to set them at liberty. As it is very difficult to satisfy an inquisitive reader by imaginary descriptions, I refer his curiosity to the following observations upon this head.

The Trichiasis, or Phalangosis, are three rows of eye-lashes, placed in such an inward disposition, that it is termed a disorder, as they continually inflame and rub on the globe of the eye, produce excruciating pains, and sometimes the loss of sight, if they are not plucked out.

The overturning and retraction of the eye-lids are commonly looked upon without any hopes of a perfect or radical cure. This disease depends upon the inferior eye-lid: it exists in the orbiculary muscles, on account of their weakness or relaxation, especially in old people, without the least cicatrice. When the eye-lid overturns of itself, and shrinks in such a manner, as to cover no more the globe of the eye, and that the part of the conjunctiva, which lines it inwards, is turned outwards; you have nothing left but the operation, after having tried, to no purpose, the use of emollient and humecting fomentations, agglutinative and astringent plaisters. In short, such cases are always of a very difficult curation: the main end is, to re-establish, as much as possible, the natural dimensions of the eye-lid.

The Schirhus in the eye lids, is a very common disorder, occasioned by intercepted perspiration, thick humor, which remains in a particular place for a long while and becomes very often a hard tumor. Any lotion that

softens, is of great service in this case, but not sufficient to destroy the malady without return; then you have nothing else to do but to attempt the re-establishment of the glands of Meibomius, whose obstructions are the principal cause.

The Fistula Lacrymalis is a disorder existing in the canals leading from the eye to the nose. It is produced by an obstruction in the natural course of the tears, and makes them trickle down the cheeks. This defluxion indicates sometimes a purulent serosity, or true corrupted matter contained in the saccus lacrymalis, which flows from the great angle of the eye (either spontaneously, or in compressing the saccus lacrymalis with the tip of the finger) over the cheeks. It comes very often from the ulceration of the lacrymal ducts, and oftener from that of the bag. If the ulcer is of an acrimonious nature, the fistula lacrymalis is to be feared. This ulcer corrodes oftener the saccus lacrymalis than the teguments which wrap up the bag, and very seldom the neighbouring bones. In a fistula lacrymalis, the purulent serosity goes out of the bag through the puncta lacrymalia; when the bones are at the same time corroded, there is a solution of continuity to the skin and complication with caries, then the matter runs down into the nose. A physiological account of the lacrymal ducts, and some observations, will be sufficient to give a comprehension of all the diversities to be met with in a disorder so very common and difficult of curation.

PHYSI-

PHYSIOLOGICAL ENQUIRY

INTO THE

LACRYMAL DUCTS, AND THE ORIGIN OF THE LACRYMAL FLUID.

EVERY one may judge of the importance of the lacrymal organ by its function. Nature formed it to receive the fluid which runs through different excretory ducts to lubrify the eye, and the internal parts of the eye-lids: at the ſame time, this fluid keeps the tranſparency of the cornea; without its help, the functions of the eye would be ſuſpended, or at leaſt very much injured.

The harmony which exiſts between the *productive lacrymal ways*, and the *abſorbent* ones, deſerve all our attention. On the one ſide, we remark a conſtant exudation which drops from a great many pores and excretory ducts; on the other, two lacrymal points and ducts to pump or abſorb all the lacrymal ſeroſity, except what is evaporated in the air.

Though anatomiſts have been employed this great while about that eſſential part, the deſcription they have given of it leaves ſtill a good deal to deſire for the perfection of our knowledge. The greateſt number amongſt them have ſaid, that the immediate ſpring, or ſource of the tears, came from the *glandula lacrymalis*: nevertheleſs, the inorganic pores of the cornea furniſh a great deal of the lacrymal ſeroſity. The excretory ducts

of

of the *caruncula lacrymalis*, the conjunctiva, and those of meibomius glands, furnish also part of the tears, insomuch, that it is very easy to prove, that the *glandula lacrymalis* does not produce one third of them.

The knowledge of a greater quantity of excretory ducts of the tears would not be of considerable importance, if it were only matter of anatomical curiosity; but it demonstrates the true cause of several disorders of the lacrymal ways, to which no attention had been paid, or which had been confounded among the rank of the other disorders of the eyes. In fact, no treatise has mentioned, 1*st*, The atony or dilatation against nature in the inorganic pores of the cornea, nor those in the conjunctiva; meanwhile, this disorder causes so great a quantity of tears, that it may have imposed upon several practitioners to such a degree, as to make them believe that there was an obstruction in the *ductus ad nasum*, whilst it might be in the most perfect state. If, in this case, the puncta and ducts lacrymalia do not absorb the tears, it is because the proportions are not relative, there having more of the lacrymal secretion than may be contained into their diameter. 2*dly*, Our authors have also been ignorant, that an obstruction in the glands of meibomius is the cause, that the oleaginous fluid, furnished by them, is in a less quantity than necessary to defend the conjunctiva and the cornea from the acrimony of the tears, and the injury of the air; for from it proceeds a flux of tears, and an inflammation in the eye, which stands against the best and well prescribed remedies, till these glands be in their natural state. 3*dly*, They have not been less silent upon the true cause of the Hydrophtalmy. This disease is produced by the obstruction in the inorganic pores of the cornea; it is the retention of the superfluous of the aqueous

aqueous humor, which extends the tunics of the eye at that time, and increaſes the bulk of the globe.

If we examine their deſcription of the puncta lacrymalia, the ſaccus lacrymalis, *ductus ad naſum*, and the mechaniſm which they ſettle to theſe parts, for pumping the tears; if we compare what they have ſaid, with what the anatomy and mechaniſm of theſe parts preſent us, we ſhall obſerve that they have neglected to deſcribe a great many eſſential parts, which manifeſt themſelves to the inquiſitive eye. It is then of the greateſt conſequence to enquire into every ſubject which eſtabliſhes the lacrymal organ, to make us acquainted with its true mechaniſm and functions, in order of diſtinguiſhing the various cauſes from whence proceed the maladies which diſturb its harmony, and point at once, and with more preciſion, at the curative indications.

Nature has divided the lacrymal ways, 1*ſt*, In parts which furniſh the tears, and thoſe which are bathed by them. 2*dly*, In parts which pump or abſorb this fluid, and in thoſe which contain them.

Of the production of the Lacrymal Fluid.

The exceſſive fluxes of the tears which are occaſioned by the introduction of an extraneous body in the eye, have this great while given an opportunity of ſuppoſing, that the lacrymal fluid had ſome other excretory ducts than thoſe of the *glandula lacrymalis*. The frequent inquiries and inſpections of ſound and ſore eyes have at laſt thrown ſome light on the ſubject.

§ 1. *Of the Glands of the Conjunctiva, and the Excretory Ducts of the Glandula Lacrymalis.*

The whole ſurface of the conjunctiva is covered with a great many excretory ducts, and inorganic pores:—But,

But are the firſt membraneous, and the ſecond the extremity of ſome arteriols? If the ſecretion through the pores of the conjunctiva was furniſhed by ſome arteriols, the conſequence would be very ſenſible in the humid inflammation: the flux of tears is occaſioned by the atony of that tunic, and manifeſts itſelf by the dilatation of its excretory pores: in that caſe, a flux of tears ſhould enſue; but this is what never happens.

Will any one object, that the excretory pores in the conjunctiva are lymphatic arteries, and conclude from thence, that the ſeroſity which is furniſhed through the pores of this tunic cannot be but diaphane, even in the atony ſtate of that membrane? To this I anſwer, Every body knows that the inflammations are cauſed by the paſſage of the particles of blood into the lymphatic arteries, whoſe tunics have almoſt loſt their oſcillation. How could it be poſſible, in the caſe of a great inflammation, that the excretory ducts in the conjunctiva might, though dilated againſt nature, put an obſtacle to the paſſage of the blood? Let us rather conclude, that this ſeroſity is furniſhed by a great many glands ſpread over the whole ſurface of the conjunctiva.

Have you ſeen theſe glands that you admit upon this tunic? I anſwer, that it is impoſſible to diſtinguiſh them in their natural ſtate; but when they are ſwelled, they are not only viſible, but you may diſcover their very frame.

Upon the conjunctiva, at two lines from the limb of the cornea in the external angle, you will ſee ſometimes little tumors very near each other; every one of them are of the ſize of a millet ſeed: take of this portion of the conjunctiva, and you will obſerve, 1ſt, That theſe tumors are in the ſubſtance of that tunic. 2dly, Cut ſeveral of them, you will have an opportunity of diſcovering with a microſcope, that they are, as to their frame,

frame, like thofe glands which are known to us. 3dly, Having left the others to be macerated in water, they fhall increafe in bulk, and you will remark, that every one of them is wrapt up in a capfule, and that their internal parts do not differ from the firft.

If thefe little tumors be fome puftles, do you fuppofe they fhould have the frame and confiftence of a very clofe web? Do you think they fhould have an exact conformity with the texture of the glands? Do but confider the eyes of feveral men, you will often remark fome of thefe little tumors upon the conjunctiva. They are nothing elfe but fome glands fwelled to fuch a degree, as to give you an opportunity of diftinguifhing them from the little abfceffes which attack that tunic. Puftles are purulent, or form fome hydatides; thefe have a fluctuation, which does not exift in the tumefied glands.

Moft part of the little abfceffes which attack the conjunctiva are caufed by the fwelling of the filters in the glands of this tunic, and by the introduction of heterogeneous parts, or by the alteration of the lymph which is become ftagnant. The acrimony and purulent matter difturb and deftroy the glandulous bodies. The puftles which afflict that tunic are fimilar to thofe which are formed all over the human frame.

It is needlefs to defcribe a greater number of thefe facts, becaufe, without having recourfe to the tumefaction of the glands in the conjunctiva, there will be no room to doubt of their exiftence, if you take notice, that this tunic is in every thing alike to moft parts of the membranes in the human body, which have a great quantity of them.

For what reafon would you exclude thefe glandulous bodies from the conjunctiva, fince almoft all anatomifts agree, that they are to be found over the whole web of the

the ſkin? Is it becauſe one is more united than the other? No, certainly. Have we not in all cavities whatſoever of our bodies ſome tunics whoſe texture is a great deal thiner, or at leaſt as delicate, which have ſome glands and excretory ducts, from whence flow, without intermiſſion, a fluid fit to water all the parts in the ſpaces which incloſe them, to impede the drying of the fibres which compoſe them, and that of the tunics which involve them? Every body knows, that the ſaccus lacrymalis and its ducts have ſome glands, from whence flows continually a ſecretory humor. Where is the exception why the conjunctiva ſhould not ſhare the general conſtruction? Did it not receive in its formation the ſame organization, and the ſame prerogatives, as the other membranes which are analogous to it?

The following experiments will prove, moreover, that its perſpiration is alſo abundant, nay more ſenſible.—Overturn the eye-lid of any one whoſe organ is ſound; wipe it with a very fine piece of linen cloth, you will obſerve, with the help of a magnifying glaſs, or without it, ſome little drops which tranſude through the pores of the conjunctiva. Theſe drops ſhall increaſe by degrees, till they form, in a little while, a ſheet of water. Wipe now and then this part, you will diſtinguiſh a new ſecretion, which ſhall be as limpid, viſcous, and briniſh, as the firſt. You will remark too, that during this experiment, the eye is very much bathed in tears, on account of their abundant ſecretion, and want of action in the puncta and ducts lacrymalia, which are not in a direction to pump or abſorb the whole fluid, furniſhed by their excretory pores and ducts.

Let the eye-lid be overturned during twenty minutes or upwards, you will perceive not only a conſtant tranſudation, furniſhed by the ducts of the conjunctiva, but alſo the flux of the tears increaſing till they fall drop by

by drop, with as much celerity, as if the ſubject was grievouſly weeping. The cornea ſhall looſe of its tranſparency, by want of brightneſs under the water which covers it; but as ſoon as the eye-lid is in its natural ſtate, its motion ſhall equally extend the lacrymal fluid, by which means this membrane will re-aſſume its former tranſparency.

This experiment is a proof, that if the glandula lacrymalis be alone able to furniſh the tears, it ſhould be neceſſary it had ſome more and other excretory ducts than thoſe which are known belonging to it. It follows alſo from this experiment, that the glandula lacrymalis, being not able to furniſh the eye with lacrymal fluid, when the ſuperior eye-lid is overturned, that the abundance of the tears which gather at the valvula lacrymalis come from ſome other ſources.

If this lacrymal fluid, furniſhed by the glandula lacrymalis, was as abundant as it has been believed, it would manifeſt itſelf by a copious ſecretion to the edge of the tarſi, when the ſuperior eye-lid is overturned: but, on the contrary, you may remark, that theſe excretory ducts do not furniſh more tears than thoſe in the portion of the conjunctiva.

Here you may object, 1ſt, That the copious ſecretion of the tears, which happens during that experiment, is occaſioned by the compreſſion of the eye lid overturned upon the globe of the eye, and that the tears muſt be in a leſs quantity than when this eye lid is in its natural poſition. 2dly, That the liquor produced by the glandula lacrymalis is intercepted on account of the overturning, which muſt occaſion a compreſſion upon the excretory ducts, to a degree ſufficient as to intercept a great part of them.

Anſwer to the firſt objection: 1ſt, The globe of the eye cannot be ſqueezed by the overturning of the eye-

 lid,

lid, becaufe its web is very foft; befides it fhould be neceffary, for the exiftence of this compreffion, that the eye-lid fhould be bent, whilft there is a fpace between it and the globe, what ftands for a proof to the contrary. 2dly, If the eye was preffed, the eye-lid and the globe would be fixed, and their motions fufpended. 3dly, The globe, on account of its rotundity, leaves in its fuperior part a fpace which cannot be filled up by the eye-lid. 4thly, The perfon whofe eye-lid is overturned, feels no pain at all in this part, which fhould happen if the eye was fqueezed by it. 5thly, Every one knows that all compreffions intercept more or lefs the flow of liquors in the veffels, from whence proceeds inevitably a ftagnation in them, and of courfe an inflammation. Let us conclude, then, that the eye is not fqueezed during the experiment, and that the flux of the tears comes rather from the fecretion which continually runs through the pores of the cornea, thofe of the conjunctiva, the caruncula lacrymalis, and through thofe called *glandulæ febaceæ meibomii.*

Anfwer to the fecond objection: The overturning of the fuperior eye-lid cannot be an obftacle to the flow of the fecretory fluid from the glandula lacrymalis; 1ft, There is no impediment; 2dly, The ducts of that gland cannot fink, though the eye-lid be overturned, confidering that any fluid, by its impulfion, has ftrength enough to widen the infides of the ducts which muft give way to it; laftly, Becaufe, if thefe ducts were to fwell during that experiment, it fhould happen, after the re-eftablifhment of the eye-lid, an abundant effufion of tears, on account of the difcharge of thefe excretory ducts, whereas the exfudation is much the fame.

Thefe are fufficient reafons and experiments to eftablifh, beyond any doubt, that the glandula lacrymalis furnifhes but a part of the tears. Will you object, that this

this experiment alone is not able to prove the existence of the execretory pores in the conjunctiva, and that it might be possible these tubes belonged to the glandula lacrymalis? The following experiments are proofs to the contrary.

Overturn the inferior eye-lid; desire the person to lift up the axis of his eye, in order to give the conjunctiva a greater convexity: put, betwixt this tunic and the globe, some lint, to keep the tears out of that part of the conjunctiva which is the subject of your examination, and wipe it with a fine linen cloth; then you will observe, in its whole extent, a great many drops, which increase by degrees just as they are coming out, and in a little while join each other. Remark, at the same time, that this fluid is wholly alike to that which exsudes out of the internal part of the superior eye lid; and that the quantity seems equal in both, proportionally to their extent.

Introduce a *speculum oculi* in the eye of a living animal, to remove the eye-lids from each other; dry, with a linen cloth, that part of the conjunctiva which covers the globe of the eye, then you will observe the same transudation as that in the interior part of the eye-lid. The dilatation of the pores in the conjunctiva is also a convincing proof of it; and the flux of the tears, which is the consequence, demonstrates also the very kind of this fluid, and what must be its destination.

§ 2. *Of the Inorganic Pores of the Cornea, and the Origin of the Secretory Fluid, to which they give passage.*

The cornea furnishes also a secretion through a great many inorganic pores, dispersed upon its surface; and, if a great number of anatomists have been ignorant, or said nothing about this function of the cornea, some have favoured us with an account of it.

The aqueous humor is produced, or regenerated into the eye, by a kind of tranſudation, through the vitreous and cryſtalline humors which having filled up the ſpace between them and cornea, flows afterwards through the pores of this membrane, to let ſome of the new humor in its place. You will be certain of it, if you take notice that the anterior part of the vitreous body incloſes always in its cells an aqueous humor.

The filtration of the aqueous humor through the excretory pores of the cornea, is evident; but this is not ſufficient; we muſt endeavour to prove, that this fluid is a great portion of the tears. To be convinced of it, clear and exact notions upon this head are neceſſary. Let us conſider, *1ſt*, The nature and quantity of the ſecretory fluid, which runs through the pores of the cornea; *2dly*, The reſervoirs of this humour; and, *3dly*, The ſources which furniſh it.

Introduce into the eye of a living animal, a *ſpeculum oculi*, which may keep the eye-lids from each other, and make a ſoft preſſure round the globe; wipe the cornea with a linen cloth; then you will obſerve a great many little drops, following one after another, tranſuding through its pores: In a little while, theſe drops ſhall increaſe till they join and ſpread over the globe of the eye. If you continue this experiment for twenty or thirty minutes, and wipe now and then the globe with a linen cloth, the ſecretion ſhall be as equal as copious, without any diminution in the bulk of the eye. This experiment, performed on the eye of a ſubject newly dead, produces the ſame, with the difference of decay in the eye; which is a proof that this ſecretion is ſupplied by the aqueous humor, which, in renewing itſelf continually in the living eye, hinders it from withering.

There

There will be no room to doubt concerning the abundant ſecretion of the aqueous humor, through the excretory pores of the cornea, if you take notice of the quantity of fluid furniſhed by the eye, when a cataract is extracted out of the organ. The cornea does not ſink, though the aqueous humor is continually running out, till this tunic be entirely healed of the wound practiſed upon it.

This kind of ſecretion is no leſs abundant when an ulcer has corroded the thickneſs of the cornea; for the eye would be very ſoon melted away, if the impulſion of the aqueous humor did not compel part of the iris to go through the hole of that tunic, in order to ſtop the too quick effuſion of it. The epiphora, (a dilatation againſt the nature of the pores in the cornea) is another proof that this ſecretion is the ſuperfluous part of the aqueous humor, and how quickly it is renewed.

After ſuch an expoſition, you may conſider the globe of the eye as a great ſource of the tears, and the chambers of this organ as two reſervoirs apppointed to furniſh this ſecretion; but now it behoves to know, and enquire into the ſources which renew it ſo quickly.

§. 3. *Of the Vitreous Body, conſidered as a Source of the Aqueous Humor, and conſequently of the Tears.*

The vitreous body is compoſed of two tunics, one cellulous, which occupies the interior; the other capſulary, which wraps up the whole. The cells are full or a diaphanous fluid, which filters imperceptibly, and flows from one cell into another, as far as the excretory pores of its capſule. This fluid is conveyed into each cell through a great many lymphatic arteries, which, from the choroides and retina, end in the interior of the vitreous body.

Cut;

Cut, in a circular manner, the middle part of the eye of a ſubject newly dead, without cutting, if poſſible, into the vitreous body; perform another half circular ſection in the poſterior part of the globe, in order that both extremities join the firſt; remove lightly the divided portions, and you will ſee that the veſſels, which from the retina end into the vitreous body, are all lymphatics, of a diameter more or leſs ſmall, and very near each other, eſpecially towards the *plexus ciliaris*. As ſoon as you put away the retina from the vitreous body, the extenſion of theſe veſſels ſhall ſooner determine the rupture of ſome of them than of the others, according to their thinneſs.

Take away the vitreous body, and wipe it with a linen cloth, you will obſerve that its ſurface has the moſt exact ſmoothneſs, a tranſudation ſhall take place all over its extent; ſqueeze it ſuperficially in its centre with a buttoned probe, it ſhall yield to its preſſure; but as ſoon as it is diſcontinued, its elaſticity ſhall reeſtabliſh it.

You will conceive the cauſe of this elaſticity if you ſqueeze very hard betwixt your fingers the middle of the vitreous body. The touch will give you an opportunity to feel a little breaking, which proves the ſinking of the part, and the rupture in the inſides of ſeveral cells, wherein is contained the vitreous humor. This is a proof that the fluid has been forced into the neighbouring cells.

Theſe cells are ſo well ſupported and heaped one upon another, that they have the ſame faculty communicated by any motion to a globulous body, puſhed by any cauſe whatever. You may comprehend, that, after ſuch a ſtructure, the vitreous body muſt yield to the leaſt compreſſion, and reaſſume its former ſtate, as ſoon as you ceaſe to ſqueeze it. At the time of a ſtrong preſſure,

preſſure, the fluid muſt break the inſide parts of the cells which contain it, and cauſe a ſinking in that part, whilſt thoſe that are near them keep ſtill their elaſticity.

But the vitreous fluid muſt tear the inſides of the cells which contain it, in removing from the point of compreſſion, though light, ſince the tunic which forms them is very delicate? To this I anſwer; Every fluid is compreſſible, and when compreſſed, it does not occupy ſo much room as before: beſides, this aqueous portion conveys itſelf in the lateral parts, and runs into the neighbouring cells through little pores which exiſt in their ſides; inſomuch, that all this fluctuation is performed without rupture, and the fluid re-eſtabliſhes itſelf as ſoon as the preſſure is finiſhed. This laſt caſe never happens, when the compreſſion is too ſtrong; becauſe the inſide of the cells cannot ſufficiently ſpread of themſelves, and with celerity enough, to obey the active impulſion acquired by the vitreous humor.

At the time of a quick preſſure, this fluid tears and forces the obſtacles which oppoſe its extenſion; from thence no elaſticity, becauſe this fluid is diſperſed and unable to produce a retro-active effect, for want of being incloſed in the cellulary ſpaces: the heap of the cells gives the elaſticity to the vitreous body, as has been already obſerved.

The following experiment will give you a clear idea of the communication which exiſts between the cells of the vitreous humor. If, after an extraction of the vitreous body, you put it in a ſpoon over two or three lighted coals, you will obſerve, when the ebullition begins, a decreaſe in the vitreous body, by the contraction of its capſule, which evaporates the fluid contained in the external cells, through the excretory pores of the capſule, and fall into the ſpoon; but the tunics of the vitreous humor ſhall (though the total exſudation of the

the fluid) keep their roundneſs during their heat, and they ſhall ſink as ſoon as the exterior air will penetrate them again.

The cauſe of this change comes from the introduction of the igneous parts into the cellulary ſpaces, which give the capſule a round form: but as ſoon as the particles of fire have no motion at all, and that the preſſion of the air, or of the atmoſphere, obliges them to yield to their weight, they run through the pores of the capſule: from thence the total ſinking of the tunics of the vitreous body.

Take the vitreous body out of an eye, and put it upon a ſheet of paper; then its tunics ſhall ſink by degrees, till no fluid remains in its cells. Obſerve, during this experiment, that the vitreous fluid equally filters through the whole pores of its capſule, and that each cell furniſhes ſo exact a proportion of this exſudation, that it is impoſſible the ſinking be quicker in one of theſe parts than in the other.

Let theſe tunics macerate into the water during three hours, you will obſerve, in taking them out, that the water has run into all the cellulary ſpaces, which ſhall be half filled. But the exſudation of this water is much quicker than that which is natural to the vitreous humor. This gives to underſtand, that if the fluid of the vitreous body had not a certain degree of viſcoſity, its exſudation ſhould be very quick,—cauſe the atrophy of this body, and the loſs of the organ.

Theſe three experiments prove, that the cells of the vitreous humor communicate to each other the fluid contained into them. Were it not ſo, ſhould it be poſſible, that the water might equally run through them, to occupy a part of theſe cellulary ſpaces? The following expoſition confirms more and more that intercourſe.

Perform

Perform a little hole in the tunic of a vitreous body, void of fluid; convey, with precaution, ſome air into it with a pipe: and, when theſe cellulary ſpaces ſhall be full, bring theſe membranes to the hole of a window-ſhutter, through which ſome rays of the ſun can come over it; then, with the help of a microſcope, you will remark, if you blow carefully from time to time into theſe tunics, that the interior air eaſily runs out, as the cells are very porous, and their ſize prodigiouſly varied. The vitreous body of an ox is by far preferable to any other for that experiment.

Their form ſhall be ſtill more ſenſible, if you expoſe, in a warm room, or to the rays of the ſun, the globe of an eye frozen; for, as ſoon as you have cut it into two hemiſpheres, each piece of ice will afford you an opportunity of diſtinguiſhing their figures and ſizes; ſome are round, others oval, triangular, and ſo forth. It is eaſy to take out theſe pieces of ice with the point of a pin, without hurting the tunics of the vitreous body.

The denſity of each of theſe tunics is different; the capſullary is much denſer than the cellulary: you will be convinced of it, if you cut into two parts a vitreous body newly extracted, and make a light preſſure with a buttoned probe over its capſule; there you will feel a reſiſtance, which ſhall keep the probe from piercing; and if you put it in the cells, it ſhall penetrate entirely into the interior part of the vitreous body, and almoſt without any oppoſition at all.

It is unneceſſary to enlarge any further upon the ſubject; therefore, as nothing is wanting now, but the proofs that the ſecretion of this tranſparent body is appointed to renew the aqueous humor, it ſhall be my next conſideration. After you have taken out of the orbit the eye of a ſubject newly dead, perform a ſection thro'

the cornea, as to extract a cataract without touching the iris; put the globe, a little inclined, upon a ſmall grate, and the whole over a tumbler; then ſhall flow, drop by drop, a diaphanous fluid, like the aqueous humor, and, in leſs than ſix hours, the eye ſhall become flat: cut the membranes, which compoſe the ſhell of the eye, you will find the tunics of the vitreous humor without fluid. Take equal parts of the vitreous fluid and aqueous humor, put them in different veſſels, to be evaporated upon a ſmall fire, till the diminution of the two thirds; after which time you will remark, that each of theſe fluids has got the ſame degree of viſcoſity as a light diſſolution of Arabic gum, and that ſome cryſtals ſwim over when they are cold. Finiſh the evaporation, each of them ſhall produce an equal quantity of alkaline ſalt: weigh them, you will know that the ſalt conſiſts of about the tenth part or upwards.

You conceive, after theſe experiments, that the fluid, ſecreted through the vitreous body, is to renew the aqueous humor: if you make a doubt of it, you may convince yourſelf, in obſerving the ſwiftneſs of this regeneration, when the humor has been entirely evacuated in the operation of the cataract by extraction. The abundance of fluid furniſhed by the eye, when the cornea is ulcerated, is alſo a complete proof of it.

As ſoon as the cryſtalloida is opened, when a cataract is couched with the needle, you may remark, if the fluid contained in it is opaque, that it is hurried away towards the anterior parts of the eye: it runs not only through the pupil in form of a vortex, but it ſpoils the aqueous humor of the fore chamber, and ends by precipitating itſelf downwards in form of a ſediment. It is not light enough to run of itſelf into the fore chamber, were it not hurried away by the flux of the humor

which

which is ſecreted through the vitreous body, when it renews the aqueous humor.

But if the tears, furniſhed by the globe of the eye, are not in ſo great a quantity as the ſecretion produced through the vitreous bodies, (which have been the ſubject of the above experiment,) this lacrymal fluid is very little in compariſon to the exſudation that has been obſerved upon the conjunctiva. I anſwer: It is impoſſible to ſet a juſt compariſon between a living eye, and one deprived of life. The impreſſion communicated to the vitreous fluid by the circulation of the lymph, which acts without intermiſſion into the living eye, determines a more abundant ſecretion through the pores of the capſule of the vitreous body; whereas, in the dead one, it is but in proportion to the ſpecific heavineſs or gravity, if the vitreous fluid runs from the centre to the circumference: conſequently, this ſecretion is exceedingly ſlower and leſs than in the other.

The ſpontaneous motion of the vitreous body is accelerated, in ſome manner, by the ſimultaneous action of the *muſculi recti;* at each winking this action is reiterated, but more conſiderable, and repeated oftener, when an extraneous body is introduced in the eye, than by a flux of tears, either abundant or common. Beſides, at each winking, the tarſi make a ſoft preſſure over the globe of the eye, which produces a great ſecretion of the aqueous humor through the pores of the cornea. You will obſerve this preſſion, when you are very ſleepy. You may alſo conceive, that every time the corona ciliaris begins to contract itſelf, a greater exſudation muſt happen through the excretory pores of the capſule of the vitreous body, and thoſe of the cryſtalloida than is commonly exiſting. Look, for inſtance, at a word of ſmall print, and ſuddenly lift up your eyes towards a diſtant object; at that time you will be ſenſible of a

motion

motion of ſinking which happens into the interior part of your eyes. If you look towards a diſtant object, and haſtily upon a near one, then you will obſerve a contrary movement.

If the aqueous humor was not renewed without intermiſſion, and if its ſuperfluity did not run through the pores of the cornea, the moſt chronical diſorders ſhould happen to the eye on account of the ſtagnant humors. When, for example, a cataract is couched, a degree of putrefaction in the aqueous humor ſhould enſue, and, of courſe, the deſtruction of the organ.

Put a cataract, newly extracted, into a little glaſs bottle, full of water and well corked, the liquid ſhall acquire, in leſs than eight days, a cadaverous putrefaction, and become yellowiſh and ſlimy. The effuſion of a purulent matter into the chambers of the eye, would be the cauſe of the ſame diſorder, and the loſs of the organ. The reſolution of this purulent matter cannot be effected but by the ſpontaneous motion of the aqueous humor, which forces it to paſs through the excretory pores of the cornea.

§ 4. *Of the Cryſtalline Humor, deemed as a Source of the Aqueous Humor, and conſequently of the Tears.*

The cryſtalline humor is lodged and confined in a cavity on the anterior ſurface of the vitreous body, oppoſite the pupil; it is wrapt up in its capſule, and bathed in a diaphanous fluid, found out by the famous Morgani. This fluid nouriſhes the cryſtalline lens, as ſome ſay; but, let the matter be what it will, it cannot be ſtagnant without becoming opaque: Nature has forſeen this alteration, in diſperſing over the ſurface of the cryſtalloida a geat many excretory pores, to give

give way to the superfluity of that humor as soon as it is renewed.

You may observe this secretion in exposing to a great light the vitreous body with the crystalline humor extracted altogether. To that effect, wipe the anterior part of the crystalloida, you will see, with the help of a microscope, a transudation which manifests itself through its pores. If you cut only the crystalloida a limpid and viscous humor, which occupies the interstice of the crystalline lens and its capsule, shall come out. It flows without intermission into the back chamber to renew a portion of the aqueous humor, which, compared with the secretion of the vitreous, will be found of the same kind.

§ 5. *Of the Globe of the Eye, deemed as the most abundant Source of the Tears.*

The great number of excretory pores in the vitreous and crystalline capsules give an idea of the quickness with which the aqeous humor is renewed, and how much its exsudation through the pores of the cornea must be accelerated and abundant; for which reason one may venture to say, that the globe of the eye furnishes almost as much of the lacrymal fluid as the ducts of the glandula lacrymalis. If you doubt of it, overturn the eye-lid of a living animal, and put over the globe of the eye a very fine piece of cambric, sufficiently large to cover it; then you will observe, that the transudation of the fluid which comes from the cornea, and penetrates through the linen, is much more abundant than that which flows from the ducts in the conjunctiva and its pores. If the eye were not the most considerable source of the tears, from whence should come those that we shed when overwhelmed either with grief

grief or joy? You conceive, that in both these states of the soul, every part is in a spasmodic motion, and that the simultaneous action of the six muscles gives a stronger pressure upon the globe of the eye at that time than at others; what determines a greater exsudation of the aqueous humor through the pores of the cornea, from whence comes this abundance of tears. Besides, the action in the *corona ciliaris*, by squeezing the anterior circumference of the vitreous body, and the lateral part of the crystalloida, may in some manner contribute to its profusion.

If the globe of the eye furnishes a great effusion, he who weeps feels a kind of pressure in the lateral parts of his eyes, and some pains for some while afterwards, because, when the organs want to make a motion, these pains are still much more sensible in the bottom of the globe of the eyes, especially when these organs are brought to a great light. This sensibility comes from a swelling in the vessels of the retina and choroides. The want of a free circulation manifests itself even upon the vessels of the conjunctiva, which at this time becomes red, as if the eyes were afflicted with an inflammation. Besides, you may remark, that the cornea has become more transparent, as well as the diaphanous bodies of the globe; and this is the reason why people, who have been crying for some time, cannot easily bear a strong light. These signs are not to be remarked with a flux of tears in the eye, occasioned by an obstruction in the *ductus ad nasum*, or in the puncta lacrymalia, for such weeping dims the sight in proportion as the fistula is of an old standing: Meanwhile, in these disorders, the weeping is almost continual, and it is not the tears alone which swell the conjunctiva, but the power of the simultaneous action in the muscles of the eye, and the great contraction in the corona ciliaris.

§ 6.

§ 6. *Of the Glandula Lacrymalis, and the Caruncula Lacrymalis, considered as a Source of the Tears.*

The glandula lacrymalis secretes without intermission through its ducts an acrimonious fluid, which is corrected by an oily humor produced by the glands of the conjunctiva, together with that furnished by meibomius glands. Without this oily humor, the whole lacrymal fluid would injure the conjunctiva, and occasion a continual inflammation and flux of tears. When this disorder happens, the fluid, which spreads itself over the globe, and afterwards over the cheeks, causes some excoriations in the skin, which proves how much the tears are naturally acrimonious.

You may know what is the nature of the secretory humor in the caruncula lacrymalis, if you take it off from a subject newly dead, and squeeze it softly between your fingers; the fluid which flows from its excretory pores is yellowish, and similar to that extracted from the ducts of the ears: It is easily diluted in water.

The caruncula lacrymalis is formed by many little oblong, whitish glands, united together, and pretty near the size of a poppy-seed, and every one of them have their particular capsule and excretory ducts; their orifices are seen upon the portion of the conjunctiva, which covers this glandulous body. You may distinguish their secretion with a microscope, in removing the eye-lids. I have seen the caruncula lacrymalis deprived of its external capsule, and that part of the conjunctiva which generally covers it was then destroyed; the glands were separated from each other and adherent at their basis, like so many little bladders tyed together by the neck. That disorder was, in my opinion, incurable, and the little glands, in that state, had a reddish

reddish appearance: The eye was found in every other respect.

When the filters of this gland are in an atony state, the secretion furnished by the excretory ducts is very abundant, and like a purulent matter, commonly called the gum of the eyes. In this state, the humor does not dissolve with the tears; for which reason, this disorder is never existing without a flux of tears, that discontinue as soon as the caruncula lacrymalis is re-established in its natural state.

The caruncula is not only necessary to mitigate the acrimony of the tears by its secretion, but also to impede them from spreading into the great angle, and from thence down the cheek. The *valvula semilunaris*, formed by this gland, together with the conjunctiva, serves to direct the tears towards the puncta lacrymalia.

§ 7. *Of the Glandulæ Sebaceæ Meibomii, deemed as a Source of the Tears, and their Corrective.*

Moreover, it was necessary that the tears had some corrective able to asswage the sharpness of their acrimony, because the caruncula lacrymalis cannot produce a sufficient quantity of oleaginous humor to do it: besides, the situation of this gland is not fit to convey this humor, and spread it over the whole surface of the globe of the eye. Nature has taken care of that, by the means of a great many glands, situated under the tarsi of the eye-lids. They are dispersed in a row, and havee ach their own duct, whose orifices open at the internal edge of the tarsi, at an equal distance from each other. These glands are in a greater number at the middle of the tarsi than towards the commissures. It is essential to observe too, that there are a great quantity of them in the superior eye-lid, than in the inferior. Each of these glands are

are commonly of the ſize, form, and color, of a little white poppy ſeed; every one of them has a particular excretory duct, which pours out the oleaginous humor into the common duct; and this pours it out again to the edge of the tarſus, where it is diluted into the tears at each winking. The color and conſiſtence of this humor is like the white honey, lightly mixt with amber; and it is not only fit to correct the lacrymal fluid, but yet to help the motion of the eye-lid, and moderate the action of air upon the viſual organ. You may alſo conſider this humor as a kind of plaſtering, proper to diminiſh the too great ſecretion of the tears. Meibomius glands are never diſeaſed, without the conſequence of an immoderate flux of lacrymal fluid.

Theſe glands are attacked with the ſame indiſpoſition as thoſe of the caruncula lacrymalis. The gum of the eyes is not wholly diluted by the tears; for which reaſon, it gathers at the edge of the tarſi, and glues the eye-laſhes to one another in the night time, to ſuch a degree, as to cloſe the eye-lids ſo faſt, that you can hardly open them, and take it off when dry.

If you compare the number and diameter of the excretory ducts of meibomius glands, and thoſe of the caruncula lacrymalis, with the excretory ducts of the tears placed at the internal ſide of the ſuperior eye-lid, you will know that this ſebaceous humor may amount to the eighth or ninth part of the lacrymal fluid.

You may, beſides, convince yourſelf that the ſecretion of meibomius glands is diluted by the tears, if you examine that the eye-lids are ſufficiently cloſed, to hinder the tears from falling over the cheeks; that the canal formed by the union of the tarſi, is not full enough of lacrymal fluid to force them, as to be diſtant from each other; that the middle of this canal is occupied, and the remaining part of it filled by the vapor of the

tears that dilute the oleaginous humor of the glandulæ sebaceæ of the superior eye-lid: so that every thing proves the secretion of meibomius glands to be a part of the tears.

§ 8. *Of the Quantity of the Tears, their principal Functions, and which Way this Fluid flows.*

The tears are not only to water the internal part of the eye-lids, to keep, soften, and moist them in a suitable state, and maintain the brightness and transparency of the cornea; but to moderate the action of air which strikes this organ, to carry towards the internal angle, and from thence out of the eye, the extraneous bodies which are introduced in it. To that end, nature increases the secretion of this fluid, by a stronger simultaneous action of the six muscles of the eye, to assist the organ in getting rid of them. The tears help also the refraction of the rays of light. It was consequently essential, that the lacrymal fluid should be uniformly spread over the surface of the globe, and that the winkings were repeated; in order the tears should not form some inequality, which, in causing false refractions, might be hurtful to the quickness of our perceptions.——Moreover, the flux of the tears being continual, hinders those tears which water the interior of the eye-lids, to go back into the excretory ducts from whence they came. You may conceive the quantity of the lacrymal fluid in proportion to the rotundity of the globe; and when it is too copious, or in less abundance than in the natural state, various and dangerous disorders must ensue. In fact, the too great secretion of this fluid occasions the epiphora, or flux of tears, which diminishes the perceptions. A less quantity than is necessary to water the eye and eye-lids, causes

causes a great deal of pains by the immediate touch of these parts, especially at the time of their motions: This indisposition is a symptom of spasm in the fibres of the organ.

In the space of four-and-twenty hours the secretion of the tears, produced by each eye, is commonly two ounces or upwards. To have the proof, put to the circumference of one of your eyes, a little drinking glass to keep the exterior air out, and let it remain so for half an hour; you will observe a light vapor, which, in a little time, forms some drops over the whole extent in the inside of the drinking glass; these drops will amount to the weight of twenty, or five-and-twenty grains. If you examine the kind of this fluid, you will find it free from the viscous and salted parts which are mixt with the tears. It is doubtless one of the causes which renders the fluid squeezed out of the saccus lacrymalis more viscous, when the *ductus ad nasum* is obstructed. This fluid is also more viscous than the aqueous humor, which becomes so too, as soon as it covers the surface of the globe; because it is mixt with the secretion of meibomius glands, and that of the caruncula lacrymalis.

Every body knows, that the puncta and ducts lacrymalia absorb the tears, which cannot be evaporated; but it remains to know what may be their quantity. If you would be acquainted with it, squeeze with precaution the saccus lacrymalis when the *ductus ad nasum* is obstructed, and gather exactly the fluid contained in it, from twenty to twenty minutes. In the space of an hour and a half, you will gather the weight of thirty or thirty-five grains, what amounts to a drachm, with the portion evaporated: consequently the total of the tears, spread over the globe of the eye in the space of four-and twenty hours, amounts to two ounces or upwards. People who make use of spectacles, have had

ſeveral opportunities of obſerving, that the evaporation of tears tarniſhes very much the glaſſes, as well as the circle which ſurround them.

It is needleſs to obſerve, that it was neceſſary the lacrymal organ had ſome ducts to pump the ſuperfluity of the fluid for its perfection. Let us now conſider what they are, and their mechaniſm.

OF THE ABSORBENT LACRYMAL WAYS.

The abſorbent lacrymal ways are made up, 1*ſt*, Of the groove in the os unguis, and the bony *ductus ad naſum*; 2*dly*, Of the ducts and puncta lacrymalia, with their common duct; 3*dly* Of the ſaccus lacrymalis; 4*thly*, The naſal duct. All theſe parts, but the firſt, compoſe one and the ſame continuity.

§ 1. *Of the Structure of the Puncta Lacrymalia, Saccus Lacrymalis, and Ductus ad Naſum.*

The puncta lacrymalia are cartilaginous, and always open in a ſound ſtate. If they were membraneous, the leaſt compreſſion would ſink and put them in ſuch a ſituation, that they could not continually receive the tears, as ſoon as they are gathered at the valvula lacrymalis.

The puncta lacrymalia contract, when an extraneous body touches them, and dilate when out. They have very ſenſible vermicular motions, which happen at every winking. To be convinced of the truth of it, lift up the ſuperior eye-lid, and touch the lacrymal point with a buttoned probe, this orifice will immediately contract. Overturn a little the inferior eye-lid, and try the ſame

experiment

experiment upon the other; then you will have an opportunity of obſerving the ſame contraction, with this difference, that it will not ſhrink ſo much as that of the ſuperior eye-lid. Lift up a ſecond time the ſuperior eye-lid with your fingers, then you will ſee a kind of nipple of a line long, coming down on the inferior lacrymal point at every winking; and that the hole, which is at its end, is very open, and its diameter larger, than uſually that of the inferior lacrymal point. The direction of this nipple is towards the valvula lacrymalis, and a little inclined upon the groove of the caruncula lacrymalis. If you let the eye-lid more downward, it will come down the valvula lacrymalis. As ſoon as the eye-lid is up, the orifice of the nipple is cloſed, and its exterior length diminiſhed to ſuch a degree, as to be entirely out of ſight. This gives to underſtand, that there is a periſtaltic or vermicular motion in the whole extent of the lacrymal duct, when this nipple gets in again.

Overturn the inferior eye-lid, during its action, you will ſee a nipple, which goes out from the lacrymal point as a kind of convexity, from within the inſide of the duct, and that this nipple is ſhorter, the diameter of its orifice larger, and its contraction leſs, at the time of its re-action, than that of the ſuperior eye-lid; but it will diſappear as quickly as the ſuperior. Compare, furthermore, the puncta lacrymalia together, you will ſee that the inferior is twice wider than the ſuperior.

If you remove with your fingers both eye-lids from each other, you will obſerve that the ſuperior goes up and down perpendicularly, and the inferior obliquely. The action of the latter moves its tarſus from the external angle to the internal, in raiſing the lacrymal point upwards; its re-action makes it retrograde, and, for want of action, it remains horizontal.

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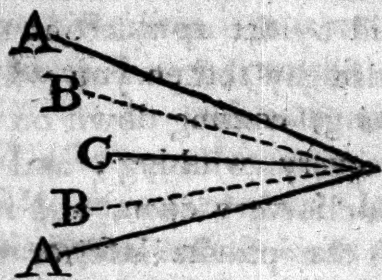
The lacrymal ducts, in joining together in the internal angle, under the middle tendon, look like this figure;



When the eye-lids are entirely open, their tarsi are in the situation A A; then the inferior lacrymal duct is horizontal, whilst the superior is inclined. When the tarsi are in the position B B, the inferior lacrymal duct keeps a small inclination, and the superior is less inclined than it was in A A. When the eye-lids are closed, the ducts are in C; then the superior lacrymal duct is horizontal, and the inferior inclined; insomuch, that the superior runs over the globe three times more than the inferior, to arrive at the point where the tarsi meet together. These changes happen at every winking, and produce some particular effects, like the nipples of the puncta lacrymalia.

By what mechanism the puncta lacrymalia do contract, dilate, and stretch forth their nipples, and pull them back to a degree that nothing of them remains, is a question we must enquire into. You will believe that these orifices have a sphincter, and their ducts a plane of straight fibres, if you examine their motions: this idea comes of itself, after the knowledge one has of the subject. As the speculation is not sufficient, we must have recourse to observation and experiments to sustain it.

Every thing tells that the tears are detained, during some time, into the saccus lacrymalis, as the urine is into

to the bladder; therefore the retention cannot exist without a sphincter in the lacrymal bag. The tears are also poured out into the nostril, but only when this sphincter is dilated by the contraction of the saccus lacrymalis, occasioned by the pressure of this fluid over the bottom of its reservoir.

Instil in your eye some drops of a bitter liquor, and put your head inclined backward, this fluid will very soon go through the puncta lacrymalia. If the tears flow directly into the nose, and from thence into the throat, you will taste an insupportable bitterness: but if there is a space of two or three minutes before you taste it, you may conclude, that this liquor has been detained into the saccus lacrymalis; consequently the tears gather in this bag to a certain quantity, till it contracts itself to open its sphincter, and let them run through the *ductus ad nasum*.

If the *ductus ad nasum* had always had its diameter open, a very sensible effect should have been the consequence at every time you would have blown your nose. In fact, the air, by going in through the puncta lacrymalia and nose, should force the tears to run back into the eyes. This is what generally happens to those who have occasion for an artificial tube into the *ductus ad nasum*, when the saccus lacrymalis has been destroyed by any disorder.

If you squeeze with your fingers upon the saccus lacrymalis, to force its obstacle, and give an issue to the tears through the *ductus ad nasum*, you will doubt no longer of a retention of tears into it, on account of a contraction in the sphincter. You conceive easily the impossibility to let the tears out by a simple pressure, through so great an obstacle, if the retention of this fluid is really occasioned by a total obstruction in the *ductus ad nasum*, phlegosis, or a callosity in this part.

Every

Every body knows that there are ſome retentions of tears which do not yield to the ſtrongeſt preſſion upon the ſaccus lacrymalis; and even when you ſqueeze with your fingers, this fluid, inſtead to flow down the noſe, runs up through the puncta lacrymalia. This, however, is not a proof that the obſtruction in the *ductus ad naſum* is not occaſioned by the contraction of its ſphincter. If there are ſome ſubjects in whom the ſphincter yields to the effort of the preſſion, this is becauſe its fibres are not in a ſpaſm or erithiſm; for they have ſoftneſs enough to be dilated, but not ſufficiently to be ſubmitted by a contraction in the bag, and the ſpecific gravity of the tears contained in this reſervoir.

Every practitioner may have had an opportunity of obſerving, that ſome people have almoſt a continual flux of tears during the day, and the ſaccus lacrymalis ſwelled; whilſt this tumor diſappears, as well as the flux, during ſleep, and that both theſe diſorders appear again as ſoon as they are up. The glands of the ſaccus lacrymalis, though ſmaller, are analagous to thoſe of meibomius glands and caruncula lacrymalis. If the latter furniſh ſome purulent matter, commonly called the gum of the eyes, when theſe filters are obſtructed, why thoſe of the former ſhould they produce none? It is moſt probable, that theſe glands furniſh the ſame humor, when their filters are in an atony ſtate, and that this humor is acrimonious enough to irritate the naſal ſphincter, to ſuch a degree, as to intercept, by its contraction, the paſſage of this purulent matter, as well as that of the tears.

Theſe fluids extend the inſide of the ſaccus lacrymalis, by gathering into it: this is what forms a tumor more or leſs conſiderable, eſpecially when the membrane of this reſervoir does not keep its natural oſcillation. If the fibres which compoſe it have ſtrength enough, the ſtagnant fluid goes up through the puncta lacrymalia; but

but when the humor which flows through the glands of the ſaccus lacrymalis is acrimonious to a greater degree than uſual, then the ſphincters of the puncta lacrymalia acquire the ſame corrugation. In this caſe the purulent matter cannot get through; it gathers, extends its reſervoir, corrodes its interior parts and teguments, and at laſt forces every obſtacle to ſpread itſelf over the cheek. This thick and yellow matter may be miſtaken for ſome pus, and make one believe there is an ulcer in the interior part of the ſaccus lacrymalis.

It is a very uncommon caſe to ſee the os unguis carious without an external cauſe. Let us ſuppoſe, for a moment, the inſide of the reſervoir ulcerated on the ſide of the os ſo as to furniſh a quantity of matter; in ſuch a caſe, the loſs of ſubſtance ſhould be unavoidable on that ſide, and the thinneſs of the membrane would lay bare the bone in a little time: from thence the moſt chronical diſorders would enſue, by the impoſſibility of healing the ſaccus lacrymalis; and the exfoliation of it, together with an irregularity in this part. The humors, and their too great abundance, the want of ſyſtole in the tubes, the paſſage of the particles of blood into them, the ſtagnant tears in the reſervoir, the erethiſm in the naſal ſphincter, the atony ſtate of the membrane of the ſaccus; laſtly, the acrimony of the tears and humors, which irritate the naſal ſphincter by their touch, and produce a ſtay in this reſervoir, are ſome other cauſes ſufficient to produce ſeveral diſorders.

Every one may juſtly conclude, that a retention of tears has been very often miſtaken for the fiſtula lacrymalis. However, there is no impoſſibility to meet with an ulcer in the ſaccus lacrymalis, as well as in the other parts of our body; but the caſe is very uncommon. A diſorder in the glands of the lacrymal reſervoir, is

often deemed an ulceration; and this is as common as the former.

§ 2. *Of the Mechaniſm of the Abſorbent Lacrymal Ways which pump the tears.*

The puncta lacrymalia, the ſaccus lacrymalis, and the *ductus ad naſum*, compoſe but one channel, whoſe form and uſe ſhould be termed lacrymal ſyphon. Two things are neceſſary in a ſyphon to pump the tears; firſt, that it be full of fluid; ſecondly, that the branch which ſoaks into the liquid be ſhorter. When the ſyphon is full of tears, and the holes always open to the lacrymal fluid, the tears flow from the higheſt branch into the loweſt; and this is ſufficient to give the tears an opportunity of running continually into the noſe.

The action of the eye-lids muſt be conſidered as one of the cauſes which force the tears to flow down the puncta lacrymalia. You meet with a convincing proof of it in a retention of tears: in fact, the tears run into the ſaccus lacrymalis during this diſorder, and not by the mechaniſm of the lacrymal ſyphon, becauſe it is ſhut: therefore the action of the eye-lids, in this caſe, is the only cauſe which forces the tears to run down the puncta lacrymalia into the ſaccus lacrymalis; for which effect, the eye-lids force the tears through the puncta lacrymalia, with the whole power of a ſpring ſet looſe. Let us begin to deſcribe the motions of this wonderful hydraulic engine in its natural ſtate; this will be the only way to know the exact pathology which refers to the lacrymal organ, and improve in the phyſiology of this part.

As ſoon as the action of the eye-lids begins, the longitudinal fibres in the lacrymal ducts acquire a quick movement of extenſion, which forces the anterior extremity

tremity of every one of these pipes, to stretch forth in the form of a nipple. This dilates at the same time its orifice, which, being a little inclined towards the globe of the eye, runs swiftly into the groove of the caruncula lacrymalis, and steeps into the tears by the power of the oblique motion of the inferior eye-lid. At the same time of the re-action of the eye-lids, each nipple, in going back quickly towards its ducts, acts as a piston, able to pump a bulk of fluid relative to the superfluity of the tears. Besides the contraction in the sphincter, which happens at that time, quickens their intromission into its duct, and the systole and vermicular motion of it, hurries away the tears into the reservoir. This forcing and lifting pump renews this mechanism at every winking, what is sufficient to absorb or lift up the superfluity of the lacrymal fluid.

The two pistons of the lacrymal ducts are also in action, to pump the tears during sleep. It is not the oblique rising of the inferior eye-lid, which forces this fluid to run into the groove of the caruncula lacrymalis; but it is by the junction of the tarsi, which form a kind of gutter to direct the tears, together with the continual action of both the lacrymal pistons.

This mechanism is grounded upon the most exact rules of hydraulic and hydrostatic. You will be convinced of this assertion, when you compare the structure of the absorbent lacrymal ways with that of a pump which draws up water by attraction and weight. To one of this kind, levers and power to put them in motion are necessary; here both are existing, or centered in the eye-lids. Pistons which go fore and back, in proportion to the action given by that of the levers, are also necessary; here, the lacrymal nipples act as pistons. But the pistons of a pump would be without effect, if they were not involved in a pipe, whose dia-

meter ſhould not be proportioned to the bulk of the piſton. The ſame thing is exiſting in the lacrymal nipples, ſince they have no effect but when involved in their ducts. In order that a pump be forcing and lifting, the piſton muſt ſtretch forth with a ſufficient power, to ſqueeze the fluid appointed for its action, and compel it to go in with much celerity into the pipe of the pump: The lacrymal fluid performs it. To quicken the intromiſſion of the fluid into the pipe, the piſton muſt have a retrograde motion: It is the effect produced by each lacrymal nipple, in going back into their ducts. The pipes of a pump, are not only to help the aſpiration of the fluid, but yet to convey it into the reſervoir which is for that purpoſe: The lacrymal ducts anſwer this object, in pouring out the ſuperfluity of the tears into the ſaccus lacrymalis. A reſervoir of any kind has occaſion for a ſpiggot, to make way for the fluid, or its ſuperfluity: That of the tears has its own, in the *ductus ad naſum*, as a ſphincter which is opened or ſhut when neceſſary to perform the ſame function.

You conceive, after this parallel, that the conſtant occluſion in the *ductus ad naſum* cannot be an obſtacle to the paſſage of the tears from the eye into the ſaccus lacrymalis, becauſe here it is not neceſſary, as in the mechaniſm of the ſyphon, that the inferior branch be opened, to give the lacrymal fluid an opportunity of running through the ways appointed by nature for its deſcent. In a word, the paſſage of the tears exiſts by the action of two lacrymal points, not only during ſleep or awake, but in every ſituation of the body. This mechaniſm is fixed and permanent in its manner of being, unleſs the parts be afflicted with ſome diſorders. In fact, there is nothing but a decay in the puncta lacrymalia which may diſturb this harmony; the ſpaſm or atony in their fibres may alſo ſuſpend it.

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The tears cannot run out from the internal angle of the right eye, when you lie down on the right ſide; becauſe at every winking, the oblique motions of the inferior eye-lid lifts up this fluid towards the internal angle to be pumped. They cannot alſo flow into the internal angle of the left eye, though you lay down on the opposite ſide; becauſe the lacrymal piſtons pump the fluid as ſoon as it gathers there.

The momentaneous action in the lacrymal piſtons is ſufficient to pump the tears while awake; becauſe there is a certain quantity evaporated into the air. During ſleep time, a conſtant action in the eye-lids ſupplies for the air, as the ſecretion is leſs, on account of the inaction of the muſcles. The action in the ſuperior piſton is quicker than in the inferior, becauſe the ſpecific gravity of this fluid oppoſes a reſiſtance when it is lifted up; and if the effort of the piſton could not overcome it, the tears would not ſpout into the ſuperior lacrymal duct. So great an activity was unneceſſary in the inferior piſton; becauſe the fluid acquires in its fall new degrees of ſwiftneſs: beſides, the piſton and ſyſtole in the action of the duct quicken it. The heterogeneous parts which compoſe the tears, as extraneous bodies, ſalt, &c. increaſe the ſpecific gravity of this fluid, and of courſe its fall into the lacrymal duct.

After ſuch an expoſition of the difference which exiſts in the diameters of the lacrymal ducts, you comprehend, that the inferior duct gives way to a greater quantity of tears than the ſuperior; and that the inferior piſton would not have been able to perform its functions, if its eye-lid, by its oblique motions, had not directed it into the groove of the caruncula lacrymalis, and given to its duct ſuch a direction to its nipple as it might be higher than the extremity of the angle, formed by the junction of the lacrymal pipes: in

in like manner, the ſuperior piſton ſhould never have been able to pump the tears, if its eye-lid had always been kept open. Intervals between the winkings were alſo neceſſary, for otherwiſe the puncta lacrymalia ſhould pump the tears without intermiſſion, and occaſion, in many peoples eyes, a kind of aridity, which would be hurtful to the organ.

The ſmaller the globe of the eye is, the greater diſtance the eye-lids are from each other, when their eyes are open, *et vice verſa;* inſomuch, that there are a great many of the latter claſs, in whom the inferior lacrymal point is ſo lifted up, that the piſton is in continual action.

A great quantity of tears, in a voluminous eye, comes from a greater number of exeretory pores, diſperſed upon the ſurface of the cornea, and that of the conjunctiva, together with the other parts whereon the excretory ducts of the tears are to be found. We may reaſonably conclude, by cloſing the ſubject, that this lacrymal fluid falls into the throat, and from thence in the ſtomach, to help digeſtion.

CURATIVE METHODS

FOR THE

FISTULA LACRYMALIS.

THE diſorders of the lacrymal organ, commonly known by the name of fiſtula lacrymalis, have been the enquiry of the moſt ſkilful practitioners, who have invented by turns different methods to reſtore the lacrymal ways in their natural ſtate. If they have not always had the ſame ſucceſs, we may ſay it was owing to the different diſeaſes which affect the reſervoir of the tears and its attributes: for if they were ignorant of ſuch a theory as has been laid down, it is the ſtrongeſt reaſon one can give of their having wandered in all ages, and thought theſe diſorders to have ſomething very intricate in their nature, and require a method of cure quite different from all the other maladies. It is no difficult matter to conceive, that ſo many different cauſes indicate ſo many different medicaments, which ought alſo to differ from each other, in proportion to the defect one has to ſtruggle with. None of the great ſurgeons has better diſtinguiſhed theſe diſorders from each other than the famous PETIT; ſo that the diſcovery of the pathognomonic ſigns of each of them (which he poſſeſſed to the greateſt degree) being very material, to meet with as many ſucceſſes as he did, ſhall be my preſent conſideration. Theſe are the only means to perform a great number of cures, as one may be able, by ſuch helps,

helps, to point right at the curative indications offered in every diſeaſe of the lacrymal ways, and follow the ſteps of ſo uncommon a man.

The ſhedding of tears, which owes its exiſtence to that of the hydropſy in the ſaccus lacrymalis, comes from the erethiſm in the ſphincter of the *ductus ad naſum*, as it cannot contract and dilate, eſpecially when filled up with any fluid; becauſe, in this caſe, the ſpecific gravity of the tears, being not ſufficient to overcome the reſiſtance oppoſed by the contraction of the naſal's ſphincter, this fluid, inſtead of flowing through the *ductus ad naſum*, remains in the reſervoir. This dilates the bag, and occaſions in it a tenſion, inflammation, rupture, and fiſtula; as, during that time, the productive tears continue to furniſh their wonted quantity, which being barred from running into the noſe, fall on the cheek. If the cauſe of this ſhedding of tears is an obſtruction in the ſaccus lacrymalis, clear it up; then the tears ſhall flow into the noſe, the ſhedding and retention of tears ſhall ceaſe, together with the inflammation, rupture, and fiſtula lacrymalis.

If a weeping is occaſioned only by a contraction in the ſphincter, whoſe cauſe is an erethiſm, the cure ſhall not be difficult. At firſt, preſs on the bag to compel its contents to flow up through the puncta lacrymalia, and make ſeveral luke-warm injections through one of the lacrymal points, or both, with the No. XXIII. —This cooling and reſolutive injection deſtroys the ſpaſm of the ſphincter, cleans the bag, and re-eſtabliſhes the lacrymal organ in its natural ſtate. Theſe injections ought to be repeated three times a-day, without forgeting to make a preſſure on the bag before. This trifling diſorder requires ſometimes four or ſix weeks of continual attendance. The method of proceeding in this operation is as follows: Take off the crooked

crooked ſyphon from the ſyringe, and put the ſtreight one, ſcrewed up very cloſe, in its place; then you muſt introduce the extremity into one of the lacrymal points, and inject ſoftly and uniformly. When the injection does not flow down the noſe (what is conſpicuous by its flowing up through the ſuperior lacrymal point,) you ſtop it with your finger, and begin afreſh, till you think proper to put an end to it for the day. It is needleſs to mention the poſition of the patient and operator, as both chuſe naturally their eaſe.

It is no indifferent matter to be perfectly acquainted with the nature of the obſtruction in the *ductus ad naſum*, in order of chuſing the propereſt means for the cure. In caſe the purulent matter flows into the noſe, when you preſs on the bag, you may take it for a ſign, that the obſtruction is removed. It very often comes from thick humors which fill up the channel, and may be looked upon as the fore-runner of a chronical diſorder; that is to ſay, the ulceration of the ſaccus lacrymalis. This caſe, well known, ſeems only to require the deterſion of the ulcerated part. However, it ſometimes happens, that the local defect is not of ſuch a nature as it can be removed by the injections, whoſe end is to clean and deterge. When the ſkilful Mr ANEL thought neceſſary to clear up the canal of the tears, he introduced a ſilver probe through the ſuperior lacrymal point, down the *ductus ad naſum*, and injected afterwards with deterſive fluids—what was very often attended with ſucceſs; but, if the canal was obſtructed by ſome callous tubercles or cicatrices, as it frequently happens in the ſmall-pox, the obſtacle was of ſuch a nature as not to be overcome by injections, and introductions of the probe generally too weak to clear it; then, in ſuch a caſe, he did not ſucceed with that method. This probe is commonly ſeven inches long, its diameter in propor-

tion to that of the puncta lacrymalia, blunt at one end, and equal in its length. If ſometimes the operator obtains his wiſh by the above means, he may be aſſured that there was not a total obſtruction in the *ductus ad naſum;* for, in caſe there ſhould have been one, he could not have diſobliterated it without the help of ſome ſtrong probe.

To ſearch in the *ductus ad naſum* by its inferior orifice, I adviſe every perſon to begin on dead bodies, in order of acquiring the uſe of it. The execution of this operation ſeems always ſo eaſy in theſe experiments, that one will very ſoon take upon himſelf to undertake it on the living. He will, however, find ſome reſiſtances, which he will always get the better of. I think it may be of great ſervice to deſcribe them, as they might ſometimes, for want of knowing, put him out.

The difficulties, or the eaſy execution of this operation, come from the variations which are to be met with in the ſituation of the ſphincter, the different degrees of alteration it has undergone, the proportions one muſt find between this ſphincter and the probe, and the ſituation of the inferior ſhell of the noſe, which is ſometimes ſo low, that, for want of a due attention, the moſt ſkilful operator might paſs over and miſs the inferior orifice of the *ductus ad naſum.* This ſhell is placed ſo low in ſome ſubjects, that, to the anterior part there is only one line diſtance from its inferior edge to the part of the maxillary bone which correſponds to it, and moulds the roof of the palate. In ſome other ſubjects it is ſo bent, that it forms rather, to the anterior part, a round hole than an oval aperture, which ought to be the natural ſtate of this ſhell: on the contrary, it is ſometimes ſo high, and the channel ſo ſhort, that there is no difficulty to ſearch into them. I muſt further obſerve, that ſometimes the partition of the noſe ſhrinks in

in bending into one of the noſtrils, leans upon this ſhell, preſſes and ſinks it in ſuch a manner, that its inferior edge touches the portion of the maxillary bone, which conſtitutes the ſeparation of the noſtril and ſinus maxillaris, inſomuch, that the probe has a great difficulty to run into it.

Moreover, if there be an adherence from the partition of the noſe to the ſhell, and that it be anterior and inferior, it may be entangled in the crooked part of the probe, what would hinder it from going behind, where the inferior orifice of this channel is to be met with. Provided the reader be inſtructed in theſe anatomical variations, and intelligent enough to diſcover with attention the more or leſs alteration the channel may have ſuſtained, in proportion to the ſeniority and extent of the diſorder, he ſhall almoſt always be able to introduce eaſily the probe in the ſound ſtate and in that of the diſorder, with more or leſs difficulty, according as the channel's obſtruction ſhall be more or leſs conſiderable, though he operates by feel. The introduction of the probe into the bag cannot poſſibly be effected, when the channel ſhall be obliterated by a malady of an old ſtanding.

The methods which were invented and practiſed by a famous ſurgeon of Paris for the cures of theſe diſorders, were extremely ſimple, as they always conſiſted in diſobliterating the *ductus ad naſum*. The inſtruments for that purpoſe are ſome Algalies, and maſſy probes of different ſizes, and proportioned to the ſphincter's diameter; beſides a ſlender ſilver wire, with one eye at one end, blunt at the other, and a ſyringe with a crooked ſyphon. All the probes ought to be bent as a ſemicircle; becauſe they are eaſily introduced into the ſaccus lacrymalis through the inferior orifice, and exteriorly felt, as they jut out with the leaſt motion

towards the teguments. The injections made into the bag, through the inferior orifice, either with the syringe only, or through the hollow probe, go out through the puncta lacrymalia; and what remains in the bag runs down of itself into the nose through the hollow probe. This is a sort of very useful seton, which keeps not only the channel in dilatation, but facilitates also a running of the lacrymal fluid.

These instruments must be of different sizes as I said before; because, if the malady consists in an obstruction of the *ductus ad nasum*, and hinders an hollow probe from going in, on account of its weakness, one ought to make use of a massy one. When the probe is once into the bag, let it be left there for some days, to facilitate the first injections; or if this cannot be practised, introduce a small straight and hollow probe through the same channel into the saccus lacrymalis, and let it remain there till the cure be quite obtained. In this manner one has the advantage that the patient may syringe himself, and save by this means a great deal of attendance. If the saccus lacrymalis be pierced on the side of the os unguis, and that it be altered, I do not advise to make a hole in the skin, and in the portion of the bag which corresponds to it, in order of applying proper remedies to obtain the exfoliation of it, as the injection alone is sufficient to produce just the same effect.

After having mentioned the necessity and possibility of searching the *ductus ad nasum* by its inferior orifice, nothing else remains now but to explain the manner of performing it. Simple as this operation seems, nevertheless one must be well acquainted with the structure and situation of these parts, the variations they are susceptible to undergo, and the proportions between the probe and *ductus ad nasum*, in order of obtaining a complete success. This theory is quite necessary. I

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now ſuppoſe the reader has acquired all this knowledge by the above deſcriptions. The patient being ſeated on a chair, the head half reclined back, the operator ſhall introduce the probe into the noſe, in conducting the end towards the arch formed by the inferior ſhell of the noſe, to ſeek for the inferior orifice of the *ductus ad naſum*. He will know that the end of the probe is in this channel, when it will no more play under the ſhell; then he ſhall puſh it in by degrees, till its end be near the middle of the ſaccus, or its ſuperior extremity. There are, however, many caſes wherein the probe does not appear ſenſibly within, though it be arrived to the ſuperior part of this channel; becauſe it ſtops under a little portion of the maxillary bone, which forms the ſuperior and anterior part of the *ductus ad naſum*. Then take up a little the end of the probe, and at the ſame time puſh it upwards; its top, which was only in the channel, ſhall go into the bag, wherein it may be felt with the finger. The hollow probe is introduced with the ſame precautions as the other. If one will have it entirely hid in the noſe, he muſt make uſe of the probe bearer, to place it more conveniently; but the probe ſo placed, is very troubleſome to make the injections. A ſmall and round ſtiletto, made of whale bone, to clear the hallow probes, is abſolutely neceſſary; and this little ſtick muſt not go farther beyond it than one or two lines. As to the method of injecting with the ſyringe, and the crooked ſyphon, the ſame precautions ought to be obſerved as to ſearching. The ſame ſyringe is ſufficient for any ſubject whatſoever, requiring only a change of ſyphon, according to the ſhell of the noſe; for it matters only to place its top in the channel's entrance, and ſquirt the liquor with the ſucker, taking heed of not filling too much the ſaccus lacrymalis, for fear

fear of a too great dilatation, which might make it lose its natural elasticity.

Each method may have its inconveniencies and insufficiencies, when the disorders vary. If the obstruction in the *ductus ad nasum* be complicated, one ought to make use of a massy probe, as I said before, to force open the passage; but there are inconveniencies and dangers by doing so, because, in searching on the living, one may not meet the orifice of the *ductus ad nasum* as easily as he would wish. It happens very often, that he does find it out, but after many painful and troublesome gropings, and in perforating false ways, an operation which may be attended with a great many accidents, on account of the tearing and irritation of the pituitary membrane. The most skilful operators, in such cases, are almost always liable to fracture in attempts made with care and sufficient precautions, *a fortiori* young beginners. From these difficulties, the method of searching this way, has met with founded criticism from the most learned surgeons; but yet those who have invented, improved, and practised it with success, are, I think, sufficient grounds to promote and credit so useful an operation, when undertaken by steady hands, and exact anatomists. This operation may be useful for persons who are unwilling to submit to an incision, as a great many would sooner go through any pain than undergo an incision.

The disorders of the bag may be of such a nature as not to be removed by the help of injections, or the searching with the massy probe; in this case Mr Petit's method must be made use of as the last resource. It is founded on the structure of the parts and mechanism of nature, to re-establish her functions. It has the advantage over the other, as it gives much less pains than that whereby one runs the risk of breaking the bones; and

and if it has not been generally practiſed, it comes from the varieties in the fiſtula lacrymalis. We ought to look upon it as a ſtem, whereon they have grafted ſeveral particular inventions with more or leſs reflection, which, far from deſtroying its good advantages, do honor to their inventors, as all theſe methods tend to repair and preſerve the natural ways of the tears.

Practitioners agree on the neceſſity of opening the bag by an inciſion, in caſe the injections and the above method cannot ſucceed. This happens always when the interior of the ſaccus lacrymalis is become ſpongious and far ulcerated. This is very eaſily known by the quantity of matter which gets out with the tears. When the bag is open, it is very material to conſider in what ſtate may be its internal ſurface, and examine it, eſpecially on the ſide of the os unguis, with a blunt probe. The alteration of a bone ſo thin ought to be cloſely inſpected; but its orbitary face may be diſcovered by the ulceration of the bag. This bone poſteriorly ſupported by the pituitary membrane and perioſteum, in the circumference of the denudation, ſhall never be able to fall down of itſelf; and as it has no diploe, one cannot expect a fleſhy coverture, which would help its conſolidation with the neighbouring parts. In ſuch a caſe, no other expedient is left but to deſtroy it. You may even have in this caſe an intention to eſtabliſh an artificial way for the tears. This depends on the ſtate of the *ductus ad naſum*. We have many inſtances, and full authority to prove, that Mr Petit had operated ſeveral patients after this method without ſucceſs, though the *ductus ad naſum* was very well cleared up, and that they were perfectly cured only after the os unguis had been ſunk. If the *ductus ad naſum* were ſhut up by the old cicatrices, and that by the above particular caſes, it would be abſolutely neceſſary to deſtroy the os unguis,

guis, I advise to do it in such a manner, as the tears may get their course by this new way.

Mr Petit practised this operation in the latter part of his life, in a different method to that of the year 1734. This is more simple, and proves the fecundity of the author's genius. An assistant puts his thumb on the commissure of the eye-lid, at the side of the little angle, and pulls them to bend the skin; what operates a small jutting out in the tendon of the orbiculary muscle. The operator leads the extremity of his knife, from one of the sides of the groove (under the tendon) to the edge of the orbit; and at three or four lines from the commissures of the eye-lids, sinks it by degrees into the saccus larymalis, without touching the bone, and performs an incision, which ends towards the tendon of the *obliqui inferioris*. If a little exterior aperture has been done, he crosses it in performing the incision. This over, and the back of the knife turned on the side of the nose, he leads the sharp end towards the *ductus ad nasum*, and then introduces, by the help of the groove's knife, a wax probe, which he pushes inwards by degrees, and leaves it there. It is observed, that this wax probe ought to be changed every day. He injects from time to time, through the puncta lacrymalia, and the bags aperture, a detersive liquor, (No. XXIV.) to clear the ulcer, and keep open the exterior aperture of the teguments with a small pledget or algalie. When he thinks the channel well shut, and the ulcer cicatrised, he makes no more use of a wax probe, but only of a small plaister on the exterior wound, and continues still, for some time, to inject through the puncta lacrymalia. This method requires one knife whose grooves must be on each side of its back surfaces.

A practitioner must consider and weigh the several cases and methods offered above, and endeavour to know

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to what length they may be ſerviceable or neceſſary. There are ſuch proceedings as might be equally of uſe, but which do not deſerve the preference over the other methods, though they could anſwer quite the ſame view. He ought to apply himſelf to the knowledge of the very caſes which require the application of one method before another, inſtead of rejecting any one of them. It is above contradiction, that to know and diſtinguiſh the nature of the diſorders is quite neceſſary, in order of being not perplexed at firſt in the application of the propereſt remedies; therefore, the curative methods for the fiſtula lacrymalis, requiring a variation according to the different caſes, the practice for the cure of them ſhall be ſure only in proportion to the juſtneſs of the pathologic knowledge, which conſiſt in the preternatural conſtitution of a man's body or part, diſcovering the cauſes, nature, and difference of diſeaſes.

Theſe are not the only cauſes which may confound the harmony of the parts that compoſe the lacrymal ways; the tumors which happen, or take riſe in the great angle towards the exterior of the ſaccus lacrymalis, being liable to act or work no leſs powerfully with the others in producing them, I ſhall mention here. Theſe tumors are commonly aſcertained by two cauſes, firſt, by a gathering of humors, which gather in a centre, by filtrating between the reſervoir of the tears and the teguments. It is, however, but very ſeldom when theſe elevations open exteriorly, as they communicate to one of the lacrymal ducts. Secondly, by the exoſtoſis of the os unguis, or the apophyſis of the coronal and os maxillary. Any practitioner may eaſily conceive, that a tumor ſituated in this part, ought, in proportion to its ſize, to ſqueeze the ſaccus lacrymalis and the common duct, as to conſtrain the motions and functions of the lacrymal organ; conſequently, that an epiphora,

or flux of tears more or less abundant, which exists as long as this unnatural elevation is not entirely dissipated, must be the consequence. All these truths summed up to the memory, one ought to understand, that each of these disorders is to be distinguished by symptoms which belong to it; but, in order of making them very familiar to the reader, I will draw a parallel between them.

In a fistula, the gum that runs up through the puncta lacrymalia (in pressing on the saccus lacrymalis) is always in a little quantity, and comes up with a very small portion of the lacrymal fluid; consequently there is no lacrymal tumor, at least, to be observed; but then the edges of the tarsi are more or less tumified, sometimes hard and overturned; besides, the vessels of the conjunctiva are varicous and inflammed, especially on the portion which lines the inferior eye-lid. To all these symptoms is added a continual flux of tears; and when the glands of the saccus lacrymalis produce a puriform humor, the tumor of the great angle is more exposed to the sight of the observer. When he squeezes upon it, a slimy humor, of an unequal colour, mixed of transparent, whitish, and sometimes yellowish parts, flows up through the puncta lacrymalia; but then the edges of the eye-lids and the conjunctiva are without alteration; insomuch, that if the patient takes care to squeeze very often the lacrymal tumor, an apparent sign of the nature of the disorder in the reservoir of the tears, by a single inspection of the organ, is no longer conspicuous. He shall know, that a tumor occasioned by infiltration, and coming off of the teguments from the great angle, and distinguish it from the foregoing by the pressure, which does not at first diminish its bulk; whilst, as soon as he squeezes the lacrymal tumor, the fluid is emptied immediately into the nose,

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or flows up equally well through both the lacrymal points. The other tumor, on the contrary, cannot let out the fluid it contains, unleſs it be preſſed hard upon, from its bottom upwards, and not ſo if ſqueezed quite otherwiſe. When this tumor is not too voluminous, a flux of tears is not always the conſequence, though patients ſhould neglect to ſqueeze it; becauſe, in this laſt caſe, the ſaccus lacrymalis may be emptied only when one has a mind to avoid a conſpicuous weeping.

The exoſtoſis of the os unguis, apophyſis of the coronal, and that of the os maxillary, are very eaſily diſtinguiſhed from the tumor in the teguments, as this laſt is flexible, whilſt the exoſtoſis is hard, and ſometimes unequal in its ſurface. The hydropſy in the reſervoir of the tears, is known by the reflux of a diaphanous fluid, ſometimes mixt with ſome ropy matter, but never with puriform's.

The ulceration in the ſaccus lacrymalis, is to be diſtinguiſhed, by very different ſigns, from thoſe I have been juſt deſcribing. It does not ſettle commonly in this part, except after wounds and contuſions; and it ariſes very ſeldom by an organic defect. However, the venereal, cancerous, ſcrophulous viruſes, &c. may ulcerate the reſervoir of the tears, rather than any other corruption in the blood. But it is very extraordinary, when they gain, even with their malignity, to this very part of the great angle. The purulent matter of an ulcer in the lacrymal ways, is diſtinguiſhed from the gum and ſecretion of the glands in the ſaccus lacrymalis, by the whitiſh or ſlightly amber-greaſed color, whilſt the pus is ſometimes greeniſh, of a deeper yellow, and bad ſmell, in the other caſe. It is rare when the depravated humor in the glands of the reſervoir of the tears is accompanied with a redneſs in the great angle and calloſity in

this part; for these accidents are commonly the consequence of an ulceration in the saccus lacrymalis, especially when it has an exterior aperture. I will observe by the way, that this aperture is almost never cicatrised without the help of art; whilst that, which has been formed by the corrosion of the matter which flows from the altered glands in the saccus lacrymalis, is very easily cicatrised, and very often without the application of any remedies generally made use of to destroy the atony state of these glands.

Before dismissing the curative methods for the fistula lacrymalis, I will make one observation more, which is, that there are some species of weeping as troublesome to the patients as they are difficult of curation: there are even some whose cure it is very dangerous to undertake, because they very often produce a greater inconvenience than that which one has a mind to remove. If the cartillage of the inferior lacrymal point be destroyed, the least oscillation cannot exist; consequently part of it must run down through the natural ways, and the other over the cheek, when the superior lacrymal point pumps alone. If the inferior lacrymal point be in its natural state, and that its duct be obstructed as to hinder the passage of the fluid in the bag, a more considerable weeping than in the above case shall be the consequence; the cure of which shall consist in attempting to desobliterate it with the probe, and inject through the lacrymal point. If the obstruction be of such a nature, as not to be overcome, and that the injection, instead of going into the natural ways, does infiltrate in the cellulary texture, then discontinue this operation, and let alone the patient along with the disorder. The inferior lacrymal duct and point are oftener out of order than the superiors. I conclude, by giving an advice to every practitioner, to make an injection

jection of common water through both the puncta lacrymalia, before he determines the character of any disorder whatever in the lacrymal ways; becaufe, after fuch an operation, he may judge, with a degree of certitude, what can be the nature of the diforder he is to take care of.

"Though I have excluded from my work all kinds "of unneceffary criticifms, I cannot help taking notice "here of the new publications concerning this branch "of phyfic and furgery. One, I would not have thought "worth mentioning, had it not accounted for a gutta "ferena cured by pofitive electricity: The other, a "warm promoter of medical electricity, would have "equally commanded my filence, had it not pretended "to afcertain many phyfical and moral impoffibilities. "As to the other performances, though in many re"fpects better calculated for inftruction, I rank among "the number of thofe extremely deficient. To the "firft I object, that a blindnefs may have been cured by "electricity, as well as fome other diforders; but that "a gutta ferena has, is one of the greateft abfurdities, "or a capital miftake. To the other, that a fiftula la"crymalis is of fuch a nature as not to be removed by "any fhock whatever, when exifting either in the la"crymal abforbent ways, or by a defect in thefe parts. "I have, for the fupport of my affertions, the following "obfervations and experiments made by M. Mauduyt, "at the expence of the French government. See his "extract for 82 patients electrified. Printed at Paris, "chez Philippe-Denys PIERRES, Printer."

OBSER-

OBSERVATIONS

ON SOME OBSTINATE FISTULA LACRYMALIS.

MISS COMB, the daughter of a clergyman who lived in Prince's-ſtreet, Cavendiſh-ſquare, London, applied to me for my opinion on a fiſtula lacrymalis, in April 1782. She had undergone the operation twice, and having received no benefit, ſhe had given up her caſe for ſome time; but a tumor which took place above the internal part of the ſuperior eyelid, and gave great pains, obliged her to call for help. The ſurgeon who had operated her before was again conſulted; and, after various applications, he was of opinion, that her caſe was turning cancerous, and of courſe helpleſs. This intelligence alarmed her, and ſhe called a conſultation, to which I was required to be preſent. To be ſhort, the caſe was entirely left to my care, and here is a ſtate of the caſe at that time. There was an obſtruction at the *ductus ad naſum*, a large opening at the ſuperior part of the ſaccus lacrymalis, and the ſac itſelf exceſſively dilated. The lacrymal points and ducts to the opening in the ſaccus were ſound; a rupture of the ſaccus towards the os unguis, which was intirely bare, indicated ſymptoms of exfoliation, and a little upwards, near the edge of the orbit, there was an inkiſted tumor adherent to the coronal; the globe of the eye was continually inflammed, and could hardly bear

bear the weakeſt light. At firſt, ſhe was bled at the arm, took ſome laudanum, and the eye was fumigated with emollients. The third day after, the pains ſubſided, and afterwards deterſive ointment was applied under the lids for ſome days, to deſtroy the ſuperfluous varicous veſſels. The eye being by that time in a much better ſtate than it had been for ſome time paſt, I inciſed the tumor, out of which a black and greeniſh matter evacuated; ſhe remained perfectly free from pain. Some days after, I paſſed a blunt probe down the ſaccus lacrymalis, and forced open the *ductus ad naſum*, through the ſuperior orifice, which had never cloſed, and injected, during eight or ten days, with common warm water, to clean the ſaccus, and keep open the *ductus ad naſum*. By that time, the poſterior part of the ſaccus healed, and there remained no communication between the ſaccus, and the place where the inkiſted tumor was. I then applied a ſmall algalie to prevent the ſuperior orifice from healing, and injected both through the algalie and the lacrymal points. At laſt the tears kept their natural courſe; and having healed up the ſuperior orifice, and continued to inject only through the puncta lacrymalia, ſhe was in the courſe of nine weeks perfectly cured, and never had any complaint ſince.

Remarks. After what has been mentioned above, it will be obvious to all practitioners, that the enkiſted tumor, and the rupture of the ſaccus on that ſide, were ſufficient to prevent the orifice from healing, and occaſion ſuch great pains. I have often obſerved, that when the parts were not ſound interiorly, the opening never to heal, and be a clear ſymptom of a hidden diſorder. I have alſo obſerved, that when the *ductus ad naſum* has been forced open with a blunt probe, the orifice never

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to close or heal, when no injections were thrown by the lacrymal points, because the tears are always mixed with a thick matter, and unable to run down the nose, especially when the orifice, either performed with the knife, or natural breaking, is large, and too low. In the above case, the tumor and the contents of the saccus kept the upper part in a continual state of inflammation, therefore the healing of the superior orifice could never be expected.

In January 1784, I was called to Liverpool in England for some private business. I visited the Royal Infirmary. Mess. Alanson, Park, Dr Lyons, &c. received me with great kindness, and, after I had continued in the place sometime, they, jointly with the students, expressed a wish to hear a practical course on the diseases of the eye; and I having consented to their request, we collected all the eye-cases of the town, and those the Infirmary and Dispensary could produce. Amongst many of them, there was a barber who laboured under an obstinate fistula lacrymalis at the left eye, who had been operated before, and it was thought that no method could answer, unless the os unguis should be perforated, as the *ductus ad nasum*, after repeated probing, was too callous to practise a passage through it and keep open. At the time I saw the case, the *ductus ad nasum* was obstructed, but the saccus extremely dilated, and without breaking; the puncta were so small that the matter contained in the saccus could not easily flow up through the puncta, even with a strong pressure. I performed an incision above the common duct, at a line distant from its extremity; directed the point of the knife, its back turned towards the commisure of the internal cantus, into the middle of the sac, as low as the upper part of the groove of the os maxillaris would permit; then, without taking away the knife, I passed a blunt silver

silver probe along the knife, into the saccus, took away the knife and left the probe, with which I forced open the *ductus ad nasum*, and, in three minutes time, the blood ran down the nose—a clear indication to the operator, that the passage was evidently pervious; and afterwards took the probe away, previously enlarging the passage with different motions. This done, I injected through the orifice, and cleaned the saccus, and put in again the probe till next day, without dressing. This last proceeding was repeated for several days; and the *ductus* seeming to keep freely open, I healed up the wound, and continued for sometime to inject through the puncta, and the patient was thought cured of the complaint. Sometime after, the *ductus ad nasum* closed again, and the disorder re-appeared. The patient was willing to go through the same trouble, and, in consequence of that, the operation was repeated; but the probe was kept in the *ductus ad nasum* during three weeks, and the wound healed afterwards, and the patient was at last cured, without a return.

Remarks. It will not surprise a practitioner who has operated and attended many cases of that kind, to hear the *ductus ad nasum* close after the first or second opening. I have observed, that when the obstruction at that part is callous, it is absolutely necessary to keep in the probe so long as six weeks, before healing the wound; for, in such cases, the *ductus ad nasum* will never keep open till such time as there is loss of substance in the callosity, and often the practitioner will be deceived in that particular, it being extremely difficult to guess when it is proper to leave off the use of the probe. Patience goes a great length in such cases as these, and very often for want of it practitioners have practised through the os unguis an artificial passage for the tears,

when they might have ſucceded the natural way, had they had more perſeverance; and I really think that the perforation of the os unguis may only be practiſed when there is an exoſtoſis in the maxillary groove.

Jane Vaugh applied to me for a fiſtula lacrymalis about September 1786. She had been a patient in the Edinburgh Infirmary, and had been diſcharged in a fair way of doing well. Surgeon A—t, aſſiſted by Surgeon L—a, had performed the operation. It appeared to me, by her account, and the ſtate of the caſe, that the inciſion had been performed too low, and they thought proper to do it again higher, which inciſions formed a very large orifice: he afterwards introduced a probe to open the *ductus ad naſum*, and injected from the orifice into the noſe. Some days after, ſhe was diſcharged; perceiving ſhe was no better, came to me. I injected through the lacrymal points, and the injection paſſed through the orifice which was not then cloſed; I likewiſe injected through the orifice, and the injection paſſed in the noſe. I thought at firſt that matters were right, but perceiving that the wound would not heal, I probed carefully, and found the probe was the outſide of the ſac, what made me gueſs the caſe; upon which intelligence, I introduced a blunt ſilver probe at the top of the ſaccus lacrymalis, and ſearching down, I found that the *ductus ad naſum* was not open. To convince me of it, I put an algalie in place of the probe, and having injected through it, the injection did not paſs into the noſe. I took up the algalie, and put in the probe again, forced open the *ductus ad naſum*, and cleaned the ſaccus with warm water, and left a lead probe as big as the parts would admit. Next day I took it up again, and cleared the ſac. A few days after, the paſſage formerly practiſed at the out ſide of the ſac, healed, and matters going on ſo well, I thought that the wound would give little trouble; but

but afterwards I discovered my mistake, for it took up near a month to effect it. After I had tried every method commonly used to no purpose, I stopt the lacrymal points with two lead probes, to prevent the tears from coming into the saccus, and six days after I obtained at last my wish, and dismissed her free from the disorder.

Remarks. What I mentioned above concerning the passage of the probe at the outside of the sac by the first operator, will be an useful observation to avoid such a mistake; but I think it will be no less advantageous to the reader, to mention what was the cause the orifice would not heal. This was so large and so low that a small share of the tears could hardly keep in the saccus lacrymalis, and find way through the *ductus ad nasum*, their specific gravity being insufficient to effect it; consequently, by stopping the whole quantity, the orifice was no longer prevented from healing, and injections through it kept the *ductus ad nasum* open. This last resource I had never employed. When these small probes were lodged in both lacrymal ducts, their head being made bigger for fear they should slip in, they gave very great pain to the patient; but she was ordered to her bed to prevent their friction over the conjunctiva, and other inconveniences.

Before I finish this subject, I must say a few words concerning the method of injecting mercury into the sac to desobliterate the *ductus ad nasum*. We have been favoured by Mr Blizzard, anatomist in London, with some observations; but having put that method in practice several times without success, I must confess that I think it useless, and that the cases cured by it were no obstruction, but merely a clogging in the lacrymal sac, which disorder is very common, and may be removed by a single injection through the lacrymal point, which injection has more power than twenty times the specific gravity of the mercury introduced in the saccus lacrymalis.

CURA-

CURATIVE METHODS

FOR THE

DISORDERS OF THE EYE-LIDS.

THE eye-lids may be disordered by all kinds of tumors which affect every part of the human body. They are subject to St Anthony's fire, phlegmone, œdema, schirrhus, cancer, warts, orgeolet, internal and external fleshy excrescences, anthracosis and adipous tumors. They are also liable to slackening and overturning, uniting against nature, convulsive motions, burnings, contusions, fistulas, purigenous ulcers, itch and tetters, disorders of the eye-lashes, and in short all sores.

If an inaction exists in the superior eye-lid, that its immobility, at the same time, occasions an obstacle to vision, and that the globe of the eye be disordered by it, it will be necessary to distinguish, whether this falling down of the eye-lid be occasioned by an erethism in this part, a relaxation in the skin, or a paralysis of the muscle, which, for want of harmony with the other parts, prevent its moving up and down. As soon as this eye-lid is in a spasmodic state, one observes a stiffness every time it is lifted up with the fingers. In the single sinking it is otherwise; for the too great extension of the skin causes only a soft and regular motion, very sensible to the touch. As to the paralysis in

in the eye-lids, all the remedies which destroy the above disorders are absolutely of no use here. If the superior eye-lid be in a state of spasm, cover the globe of the eye, without having the faculty of lifting up naturally, and that no other malady besides be existing along with it,—it may be removed by the use of spirituous or aromatic fomentations, No. XVIII. and in case they are insufficient, introduce, three times a-day, under the superior eye-lid, some of the *pommatum detersivum*, No. XXXI. If one be disappointed in his wishes, there is no room to doubt that the cause of the disease is a paralysis in the muscles; then no other means remain but an operation, otherwise it must be given up. I will observe here, however, that this operation brings on a great many inconveniencies and disorders, which are very often more dangerous than that one has a mind to remove, though imperfectly; therefore I leave it entirely to the prudence and judgement of the operator to determine.

The causes of the overturning of the inferior eye-lid (except the paralysis) are commonly a tumefaction in the conjunctiva, and particularly the portion which lines the interior of the eye-lid; a relaxation in these parts in old people, whose eyes are extremely watery and weeping; cicatrices which come from some wounds, ulcers and burning: in these last cases, the overturning is more or less, in proportion to the loss or increase of substance; so that the methods of cure for this disorder offer different indications relatively to the cause which produces it. When it proceeds from the tumefaction in the conjunctiva, one ought to have a particular care to distinguish if it be inflammatory or not, if recent or old. In the first case, bleeding, emollient fumigations, and relaxing topics, will be sufficient to dispel the obstruction, and permit the re-establishment in the

the parts. Such proceedings, however, would not do for a tumefaction of an old ſtanding; for, in this ſecond caſe, one muſt employ ſome reſolutive and aromatic collyrium in fumigations, (No. XVI.) tonic and ſtimulating topics, made up according to the No. XVII.

The relaxation of the conjunctiva in old people whoſe eyes are watery, and the overturning of the eye-lid, which is always the conſequence, are very difficult of curation: they ought even to be looked upon as incurable diſorders, relatively to an extreme atony, eſpecially when of an old ſtanding. The relaxed parts, brought by degrees in a vitiated ſtate, cannot eaſily be re-eſtabliſhed; for, in theſe caſes, one ought never to expect any aſſiſtance from our art, unleſs it be with the help of ſpirituous liquors, tonic and ſtrengthening collyriums, as the No. XXXIII. which, in ſtimulating the ſolids, may diminiſh the malady, or at leaſt its progreſs.

If the overturning be conſiderable, the internal part of the eye-lid much protuberant outwards, and that the eye-lids do not come together in covering the globe of the eye; then one may take off with a knife a portion of the membrane which forms the jutting out (in its whole length) betwixt the eye-lid and the globe of the eye, or it even may be ſcarified. A diſorder of this kind ſeems particularly more ſuſceptible of curation than the others; and it is evident, that, in ſuch a caſe, one may not only relax, but at leaſt re-eſtabliſh the parts in their natural ſtate. This operation ought to be performed with a narrow knife fixed to its handle; and if, a little time after, the membrane makes ſtill a ſmall jutting out, a ſecond operation ought to take place. There are many caſes wherein the deformity is hardly ſenſible after this operation. Its dreſſing conſiſts in introducing under the eye-lid, three times a day, three drops of the collyrium, made up according to the recipe,

recipe No. XIX. The operator will have an opportunity of obſerving, by degrees, a ſhrinking in the eye-lid, and a cloſer application of it over the globe, as the patient makes uſe of this remedy.

If patients do not apply for help in the beginning of the overturning of the eye-lids, they ſtand a chance of having their deformity a great deal more difficult of curation than at firſt, and ſchirrhous. This malady is very troubleſome, and frightful to look at. However, one may not only apply remedies that will alleviate it, but even re-eſtabliſh the eye-lids in their natural ſtate. Such a cure may be looked upon of abſolute neceſſity, as the globe of the eye is very much injured by the contact of the tumor, which produces ophthalmies and pains that ſtand againſt the uſe of all remedies whatever, till the eye-lid be reſtored to a ſound ſtate. Before undertaking any curative methods, I would have every practitioner to examine, if the ſchirrhus proceeds from a general or local cauſe; I mean from a bad ſtate of the lymph; as morphewous affections, ſcrophulous viruſes; in ſhort, from a metaſtaſis, or obſtruction in meibomius glands, and thoſe in the conjunctiva.

The internal cauſes are the plethory, as well as the other viruſes which thicken the lymph; ſuch as the veneral, ſcrophulous, ſcorbutic, cancerous, morphewous, or itchy humors, coarſe and raw aliments always difficult of digeſtion, and which produce a chyle of the ſame quality, thicken the lymph to ſuch a degree as to occaſion many obſtructions in theſe parts. This complicated diſorder, and want of harmony, happen the rather, as the elaſticity and oſcillation in the veſſels are very much weakened. The external cauſes come from the uſe of too diſſecutive or reſolutive topics imprudently applied in the eryſipelatous diſorders of the eye-lids; for they ſometimes change the malady in a ſchirrhus, by diſſipating

dissipating the most fluid parts of the lymph. A cold may also condense the humors, and diminish the diameter of the vessels.

If the schirrhus be recent and without tumor; if it take up the whole extent of the edges of the inferior eye-lid; to be brief, if the eye-lashes be partly destroyed, and that the tears cannot have their natural way, on account of the destruction of the gutter which corresponds from the commissure of the external angle to the lacrymal points, these are sufficient grounds to believe, that the apparent disorder is occasioned by the destruction of the gutter, and its cause to the thickening of the lymph in general. In this case, recommend the use of a pint of whey for three doses per day, drank two hours before and after each meal. During the same time of this proceeding, one may prescribe a gentle dose of No. v. every other four days, as long as the patient's health will admit. The use of emollient fumigations, repeated in proportion to the hardness of the eye-lids, is also of great benefit. If, to the contrary, the disorder be of an old standing and local, that is, does not owe the continuation of its existence to the above mentioned cause, what happens very frequently, then one must not doubt, that the means already taken notice of, are quite insufficient, though he may look upon them as indispensable and antecedent to the use of resolutive and stimulating pommatums, which shall determine the cure. See the recipe No. XXXI.

If the tarsi of the eye-lids be overturned inwards, and that the eye-lashes affect the globe of the eye, let the skin be bent outwards with the fingers, and apply a plaister on the cheek, to keep this eye-lid in its natural situation, and change it but when too slack. If after twenty or thirty days the eye-lid be relaxed, and that the conjunctiva be able to keep its natural state of tension

ſion by the means of a cataplaſm, No. xxvii. applied immediately on the part, then one ought to judge, whether there is ſufficient elaſticity to make an equal amends for the ſtrength of the conjunctiva or not. This is conſpicuous, when the eye-laſhes are no more directed contrary ways, and do not bruſh the anterior part of the globe. Another method to remedy this diſorder, conſiſts in taking off, with curve ſciſſars, the exceeding part of the ſkin in the eye-lid, and make ſeveral ſeams. This done, the operator covers the whole with a plaiſter, and a double piece of linen cloth, to keep it tight. Six or ſeven days after, the edges of the wounds unite ſufficiently to take away the ſeams. However, one ſhall continue the uſe of the above plaiſter, till the twelfth or fourteenth day, during which time the cicatrice takes place. The eye-laſhes are no ſooner in their natural ſtate, than the patient is quite free from pains, conſequently from the diſorder itſelf.

As I have already ſpoken of the diſorders of the eye-lids above, to which I refer the reader for particulars upon this head, in order to avoid repetitions. I will only quote a few caſes that have fallen within my practice, and ſay, that one cannot lend too ſtrict an attendance to theſe diſorders; for otherwiſe, a ſchirrhus in the eye-lids muſt be the never-failing conſequence. Beſides all the above precautions in the removal of ſuch diſeaſes, it is ſtill of great importance to avoid a repercuſſion, without having thrown ſome corrective into the blood. Experience and diſcernment will lead a great way, and be the guide of an intelligent practitioner, for chuſing always the propereſt remedies; but he ought to remember, that there are ſome complicated and old diſorders which will not, nor cannot yield to the beſt methods indicated by art: Theſe kind of caſes will, I hope, always be looked upon by the ſkilful practitioner as incurables.

OBSERVATIONS

ON SOME

COMPLICATED CASES.

AN American Gentleman being in a country garden about London, in August 1781, was ſtung by a waſp at the inferior eye-lid, a little below the lacrymal point. Two or three hours after, a violent inflammation and ſwelling at the part took place; next day it increaſed to the ſize of a pidgeon's-egg, and gave excruciating pains. A ſurgeon, who was called to give his aſſiſtance, recommended a lotion of the vegito-miniralis; this repercuſſive, inſtead of producing ſome relief, increaſed the complaint, and, in ſix days time, he thought proper to apply a cauſtic on the part, but to what good purpoſe I could not gueſs. The effect was ſuch that the tumor was entirely conſumed with loſs of ſubſtance, the inferior lacrymal point and duct, together with the upper part of the ſaccus lacrymalis, were likewiſe burnt, and the greatangle ſo diſfigured, that one would have hardly thought that ſo much miſchief had been operated in ſo ſhort a time. In that ſituation, he applied to me in October following; but, What could I do? Nothing; for the complaint was paſt remedy. However, I recommended

ed warm emolient lotions to alleviate the pain and temper the acrimony of the tears.

Remarks. There is no need of a great effort to think that the waſp's ſting was left in; this produced inflammation and ſwelling. If, according to common-ſenſe, a warm emollient cataplaſm had been applied on the part, the ſwelling would never have increaſed to that degree. As to the application of any cauſtic in ſuch a caſe, a *tyro* will eaſily apprehend the impropriety of it.

Mrs Gairdner, a widow, 29 years of age, of a bilious conſtitution, and liable to hyſteric fits, had been troubled with diſordered eye-lids of both eyes, during the ſpace of two years. Various applications had been tried to relieve her, but all that had been preſcribed internally and topically proved of no uſe. About March 1782 I was called to her aſſiſtance, and found the lids exceſſively ſwelled, inflamed, and a running of thick yellowiſh matter between the laſhes, with a continual itching. At firſt both eyes were fumigated with a decoction of elder and mallow flowers for ſix times a day, during ſeven or eight days, and drank a quart of whey *per* day divided in four doſes, one faſting, the ſecond two hours before dinner, the third two hours after dinner, and the fourth before bed-time. She was afterwards purged twice at three days interval, and the lids ſwelled to a prodigious ſize, but had neither pain nor itching. Next to that treatment, a cold lotion of vegeto mineralis was made uſe of four times a day, for three days running, and the ſwelling began to ſubſide by degrees, but pain and itching began anew. Theſe were of courſe diſuſed, and warm emollient lotions ſubſtituted in their place, and afterwards cold lotions of the ſame quality: A few days after, the pains and itching were intirely gone. During the whole time, a great quantity of yel-

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low thick matter came out from the lids, and reduced them to very near their natural ſize, but kept them cloſed every morning. The next treatment was the application of the deterſive pommatum, No. XXXI. ſpread at the edge of each lid once a day, to deterge the purigeneous ulcers. Its uſe was continued for ten days, and the lids had by that time an appearance of being cured, and all applications were given over for 15 days. The diſeaſe began to re-appear with the ſame ſymptoms, but not ſo violent. Since the return, ſhe drank lemonade, took no other purgative, and compreſſes dipt in a ſolution of 15 grains of ſublimate corroſive, in a drahm of ſpirit of wine, with a gill of common water, were applied over both eyes ſhut during day-time, till her ſight began to grow dim, then it was diſuſed, and cold emollient lotions were afterwards made uſe of, which put an end to the complaint without return; but ſhe continued to drink lemonade for a whole month after, though ſhe was perfectly well.

Remarks. It is more than probable that many applications which were uſed in the above caſe, both before and during my attendance, could not operate a cure, on account of their repercuſive nature; ſince the purigineous matter, although tempered by emollients, did ſtill produce an itching at the parts, eſpecially when it was dry. The compreſſes dipt in a ſolution of ſublimate, operated on the ſame principle as in the *tenia capitis*, of which I have read ſeveral obſervations treated in the ſame manner, the humor being in my opinion of the ſame kind, as I have experienced ſeveral times. As to the uſe of the purgative and antiputrid, I muſt acknowledge to have co-operated greatly along with it and the deterſive, as a ſpecific to re-eſtabliſh meibomius glands in their natural ſtate.

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In September 1786, John Steadman, aged 49, who is now a servant to George Robertson at the Granton Farm, in the parish of Cramond, Mid-Lothian, applied to me for a complaint in his eyes, the beginning of which was 20 years before, and had laboured under it all that time, more or less, with violent and painful inflammations, so as to be unable to work for his bread these three or four years past. He had applied to the Edinburgh Infirmary, at three different times as an in-patient, but having obtained no benefit by what had been prescribed for him, he was obliged to receive maintainance of his friends. When I saw the case first, both eyes watered considerably, the lids were swelled, the lacrymal points covered, the lashes turned towards the globe of the eye, several specks over the corneas, the conjunctiva overspread with a multiplicity of big varicous vessels, both eyes could not bear the light, and the pains were so sharp, that he was at times distracted with them. I shall not take notice of what had been done before, it being irregular. The first thing I did, was to pluck out all the lashes, and recommend him to the use of frequent emollient fumigations. The pains subsided, and a vast quantity of thick humor came out of the eye-lids, and constantly kept them close together every morning. Sometime after, I introduced the *pommatum detersivum*, No. XXXII. once every other day for a week; by that time, the number of the varicous vessels became considerably less, and he began to open his eyes, but could not see on account of the specks. As soon as I was able to discover the place of the puncta lacrymalia, I passed a probe into each through the vessels which covered them, and afterwards threw an injection which went into the nose. Sometime after, the eyes became less watery, and had a tolerable good appearance. I was obliged to pluck out all the lashes once or twice

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a week, and, in time, the lids aſſumed nearly their natural ſize and functions. Five months elapſed much in the ſame way, both eyes mending gradually better and better, till at laſt he began to ſee by a regular application of the *pommatum deterſivum* above mentioned, which became neceſſary to clean the lids from the varicous veſſels, and deterge the corneas from the ſpecks. From the time I began the caſe, to the ſpace of eight months, he was cured of his complaint, except of a little ſpeck on the cornea of the left eye, but it is very thin, and from the center. Many of the laſhes had always a tendency towards the globe; and to prevent further trouble from them, his daughter, by my directions, was taught to pluck out ſuch as may become hurtful. The man comes to ſee me now and then; and I may ſay without vanity, that he owes both his cure and bread to the care I took of his caſe, which required as much patience as ſkill.

Remarks. The beginning of that complicated diſorder was undoubtedly a ſimple inflammation, and the lids turning inwards, brought the laſhes into contact with the globe, what produced great pains and the ſpecks. I conſidered it as a local complaint, and of courſe cured him without any internal medicines. As to the ſpecks and diſorders of the lids, they were only the product of the ſuperfluity of the varicous veſſels, which extended from the conjunctiva over the cornea, and ſometimes became interwoven in its lamina; for, as they diſappeared, the ſpecks diminiſhed, and the lids performed their functions.

CURA-

CURATIVE METHODS

FOR THE

EXTERNAL DISORDERS

OF THE

GLOBE OF THE EYE.

THE caruncula lacrymalis is a reddiſh elevation, formed by a conglomerated gland, and covered with the membrana conjunctiva. It makes up, together with this laſt tunic, a ſemilunary gutter, deſigned to help the paſſage of the tears into the lacrymal points and ducts. This gland, placed in the great angle, is compoſed of many others, very ſmall, and of an oblong whitiſh texture. They furniſh a ſabaceous humor and a limpid ſeroſity, which make a part of the lacrymal fluid. This humor is ſometimes changed into a thick matter called gum of the eyes,—a diſorder which foretels an atony in the filters of that glandulous body. When this gland is deſtroyed, the flux of the tears become habitual, becauſe the lacrymal points perform their functions very imperfectly. If the ſmall glands which form the caruncula lacrymalis, are in an atony ſtate, one may cure them with the uſe of tonics, ſuch as the white wine, wherein a very little quantity of white vitriol is diſſolved; or any other remedy of the ſame claſs. This conſiſts to let fall on the affected part, two or three drops of it three times a-day.

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In the angles of the eyes ſome little whitiſh, and very painful puſtles, are ſometimes to be obſerved, juſt in the ſame form as thoſe little puſtles which may ariſe on every other part of the human body. They are not even a very long while before they are opened, and ſoon changed in ſmall ulcers. Anodyne and cooling collyriums are the proper remedies before their opening; on the contrary, one makes uſe of the drying and mondifying ones when opened. If the ulcers are purigineous, they become very troubleſome, as they hinder the patient from rubbing his eyes. They are occaſioned by a ſalted and brackiſh humor, which infiltrates itſelf into the caruncula lacrymalis. To remedy this diſeaſe, make uſe of the collyrium according to the recipe No. XVI.

It very often happens, that ſome fleſhy excreſcences ariſe betwixt the eye-lids and the globe of the eye. Some of them are ſolid, ſoft, and divided from each other, as the grains of a mulberry. The cauſe of their exiſtence is commonly an ulceration, or a bad ſtate of the fluids: Thoſe that are not voluminous, and occaſioned only by an ulceration, will very eaſily diſappear by the uſe of the ophthalmic pommatum, whoſe compoſition is deſcribed in the recipe No. XXXII. eſpecially if the uſe of ſome emollient lotions before it be recommended. On the contrary, thoſe that are conſiderable, and produced by a defect in the fluids, require abſolutely an operation. To perform it, let the patient be ſeated on a chair ſufficiently high; an aſſiſtant overturns the eye-lid with two fingers, in ſuch a manner as to expoſe the tumor entirely outwards, or at leaſt as much as it is poſſible. This well executed, the operator takes hold of the tumor with a pair of tongs, or ſome other inſtrument, in order to raiſe it up for diſſection, without leaving any part whatever: but be cautious, as this is not ſo very eaſy to perform as one would at firſt imagine,

gine, eſpecially under the ſuperior eye-lid. If the patient will not undergo the operation, it may be conſumed with butter of antimony, mercurial water, or any other gentle cauſtic: but one muſt take a particular care not to touch any other part. As ſoon as the cauſtic is applied, pour a tea ſpoonful of warm milk, and keep the eye-lids up for ſome time.

The inflammation in the conjunctiva, eſpecially the part which covers the globe of the eye to the very limb of the cornea, has been very improperly divided by the ancient and modern authors. Without laying down the diviſion as they have tranſmitted it to us, and aſſerting a juſt critic upon it, I will ſeparate this external affection of the globe of the eye into two parts, the external ſhall be mentioned here. The other belonging to the nature of the internal curative methods of the eye, I will put off till its proper place.

Two cauſes may occaſion the external inflammation: without inveſtigating now their diviſion and ſubdiviſion, I will proceed to the explanation of the above only, as the curative indications are almoſt the ſame. The firſt of theſe cauſes are blows on the eye, and extraneous bodies entered under the eye-lids; the ſecond a bad ſtate of the blood. If it be produced by extraneous, let them be extracted as ſoon as poſſible; and if ſmall, or without acrimonious quality, the inflammation ſhall be ſlight and eaſy of curation with cold emollient lotions: on the contrary, if bigg, and of a corroſive quality, and have remained long under the eye-lids, bleeding and regular diet ought to be recommended altogether. It will be even very uſeful, in caſe the patient ſuffers violent pains, to fumigate the parts for ten minutes with an emollient decoction. Theſe ſimple means are quite ſufficient when conducted by a ſkilful phyſician, who knows perfectly well to multiply or diminiſh them as the caſe requires.

The cafes wherein bleeding may be avoided are when the blood is thick, and the inflammation accompanied with no fmart pains; becaufe diluents and purgatives may be made ufe of, together with the emollient fumigations, with the fame fecurity. If the inflammation be flight, fome cold lotions, repeated three or four times a day, will be fufficient to difpel it; however, bleeding, with all thefe external applications, may be practifed when patients labour under excruciating pains. With the diluent drinks, No. I. or II. the blood and the other humors become fluid: Bleeding, practifed in the firft days of the ophthalmy, evacuates the biggeft veffels. But if the blood has acquired an acrimonious quality, every one may conceive, that the lymph furnifhed by the glandula lacrymalis, being of the fame nature, will irritate the membranes of the eye, and occafion a moft violent inflammation. All perfons addicted to drink a great quantity of wine, or any other fpirituous liquors, may have had feveral opportunities of remarking, that their eyes become inflammed and painful, efpecially thofe whofe eyes are prominent; but thefe kinds of inflammations do not exift fix hours after an emollient lotion, which is a very ftrong proof of what is afferted above.

The cornea is fubject to the ophthalmy, ulceration, opacity, and difuniting from the fclerotica. The ophthalmy or inflammation in this tunic is always the confequence of that in the conjunctiva; becaufe the varicous veffels which ramificate naturally in this laft membrane, flide in and over the cornea, to furnifh it with neceffary juices for contributing to keep its diaphaneity. The ophthalmy in the cornea requires the fame medicaments as that in the conjunctiva, when the caufes are the fame. The puftles and abfceffes which affect this tranfparent membrane, are much to be dreaded, and

call

call for a ſpeedy help, when produced by an acrimony in the lymph, or the malignant ſmall pox; otherwiſe they change in hurtful ulcers, whoſe cicatrices, if large and opaque, are an obſtacle to viſion, without almoſt remedy, when of an old ſtanding. When the cornea is affected by ſome puſtles and abſceſſes, emollient fumigations will be ſufficient to diſpel them, with the uſe of diluents and purgatives. If an abſceſs on the cornea cicatriſes itſelf, and that it be an obſtacle to viſion, a diſorder vulgarly called *albugo*, when placed on the internal lamina of this tunic; then its cure ſhall be extremely difficult, even morally impoſſible, if its diameter be as large as that of the cornea, and the patient of a bad conſtitution. But in caſe it be ſmall in diameter, and on the external lamina, one may attempt the cure with No. XXXII. uſed three times a day. If this membrane becomes opaque by the ſtagnation of the lymph, and an obſtruction in the varicous veſſels which ramificate it, the diſſolving and attenuating medecines will re-eſtabliſh its diaphaneity, together with the uſe of diluent drink, when the malady is recent. If the diſorder does not give way with ſuch means, recommend the uſe of brackiſh or volatile fluid, introduced three times a day, to the quantity of two drops, No. XXXIII. If a heap of blood veſſels exiſts on the cornea, and that it forms what is commonly called a ſpeck on the eye, large enough as to hinder the rays of light from going into the bottom of the globe of the eye; then one ought to preſcribe the collyrium made up according to the recipe No. XIX. in order to deſtroy the external lamina of the cornea. Its uſe, here, is to introduce three drops in the eye, three or four times a day. If this membrane ſeparates from the ſclerotica (to which it is contiguous) if not in the whole circumference, at leaſt in ſome part of it, the humors of the eye ſhall go out of the

X 2 globe,

globe, and occasion the irreparable loss of this beautiful organ, if proper means are not made use of to prevent it; but if it be of an old standing, and that its cause be of a general disorder in the organ, then one ought to give up the cure, and pay attention only to the removal of the deformity if possible. If any abscess be the consequence of this disuniting, and that an inflammation had been existing sometime before, one ought to make use of the pommatum, made up according to the recipe No. XXXI. preceded by a lotion, with the collyrium No. XIV. Besides, the patient must keep a low and regular diet, and be purged from time to time, according to his constitution, and the case in consideration. If some internal membrane be pushed outwards in such a manner as to form a tumor called styphyloma, and exceeds a bulk incapable to be inclosed with the eye-lids, a little incision, to let out the aqueous humor, must be performed; and, immediately after this operation, let a dose of the pommatum, No. XXXII. be applied on the very part, whose effect will be to stimulate the membranes, and join them together. If the tumor appears again, let the same operation and dressing be repeated; for the success depends on the physician's experience and surgeon's dexterity, who must know perfectly well what sort of dangers they have to encounter by the operation, and the use of this remedy.

The staphyloma, properly speaking, is a tumor occasioned by the falling down or slackening of the iris, through any hole in the cornea. One may easily know this staphyloma from any other, by a change of figure in the pupil. The more this tumor is big and placed outwards, the more difficult it is of curation. In the undertaking of such a disorder, one ought to pay a proper attention to the cause that produced it, the accidents which may accompany it, and its different kinds.

If

If it comes from a blow on the eye, bleeding, and all that tends to alleviate inflammations, are pointed by art as the beſt and ſureſt means; and if the tumor remains after the removal of theſe accidents, one ſhall perform an inciſion, as I have obſerved above, in order to let out the aqueous humor, and replace the iris in its natural ſtate. If an ulcer was the cauſe, and that the hole be conſiderable, a doſe of the ſtimulating pommatum, No. XXXI. ought to be put in the eye, as ſoon as the patient is free from the violent pains, without minding the inflammation. The hiſtory of ſuch diſorders, by way of obſervations, are more capable of inſtructing young beginners than any other ſuppoſitious deſcriptions: therefore, to avoid repetitions, I refer them to the ſubject that treats of each of theſe diſeaſes.

OBSER.

OBSERVATIONS

ON SOME

COMPLICATED DISORDERS.

DAVID WALKER, wright, was in the Edinburgh Infirmary about August 1786, for a complaint in his left eye. Various applications were made for his relief; but for all the care that was taken of his case by the late Dr. Hope, he was turned out of the Infirmary without benefit. He laboured under very great pains; and being sollicited by several people to apply different things, the disease became more and more troublesome. He applied to me for assistance about November following; and the case at that time was thus: The cornea was extremely thin, and a little below the center, there was a little hole, through which passed the capsule of the aqueous humor, and next to it the inferior part of the iris; the pupil was irregular, and had little or no power of contraction and dilatation.— He suffered great pains in his forehead, temples, and towards the os maxillaris, his constitution very much altered, and he had not been able to work for a considerable time. This complaint was a staphyloma of the capsule of the aqueous humor and iris. The pain in his head was occasioned by want of circulation in the humors. The disorder began probably by an inflammation, and

and degenerated into an hypopion, which, for want of the operation, had resisted the former applications. I incised the capsule of the aqueous humor without hurting the iris; the aqueous humor ran out, and the iris returned of itself in the natural situation. He was bled immediately after, and the eye bound with a compress dipt in an emollient infusion, and ordered to his bed.— Six days after, the cornea united and healed, but this membrane being extremely thin at the part where the staphyloma existed, the iris became adherent to the cornea, and the pupil has assumed an oblong form; but the eye is not deprived of sight, for he could see his way with it, in case another accident should happen to the right eye. Since I have operated him, he has paid me several visits, and complained of some slight pains over his eye-brow and below the eye. These pains are owing to the stretch of the iris pushed forwards by the impulsion of the aqueous humor, which flows more towards that thin part of the cornea than any other part.

Remarks. The above case brought in my recollection the case which will make the subject of the following observation. I thought at first, that it would turn cancerous; but, although it had been agreed that the eye was lost as to its sight, and that I should take out the vitreous humor and crystalline, yet I did incise the capsule of the aqueous humor, as a trial, to save the eye, if it should be possible to cure the staphyloma: and as it turned out better than I had expected, no further mention was made of destroying the organ. Since the operation for the staphyloma took place, he has often sollicited me to take out the whole eye; but on my telling him the inconvenience arising from it, he has chosen to put up with the slight pains. I presume that the organ as it stands will be of very little use to him, but it

is

is far preferable to have an eye of that kind, rather than none at all.

John Thomſon, aged 38 years, a carpenter, who lived in Warner-ſtreet, Coldbath-fields, London, applied to me in February 1782, on account of a ſtaphyloma on his right-eye. He ſuffered no pains, but the eye was entirely blind. The cornea was protuberant, and part of the iris had found its way through the cornea; a great quantity of varicous veſſels covered the ſtaphyloma whoſe colour was bluiſh. I adviſed him to let it alone. Some time after he called at Mr John Sheldon, ſurgeon; but he recommending him to me, the patient remained in peace till the tumor began to grow, and become painful. When he called again, the ſtaphyloma had increaſed to the ſize of a pigeon's egg; and as the pains were intolerable, I adviſed him to part with the whole globe to prevent further trouble. He did not approve of my advice, and I did not ſee or hear of him for ſix weeks or two months. The pains were ſo exceſſive, that he was obliged to keep his bed at different times, and at laſt ſent me a meſſage by his wife, to know if I could relieve him without the extirpation of his eye. I called to convince him, that there was no time to loſe, as his life might be in danger within a ſhort time, the tumor having turned to a deep blue color; however, I recommended a poultice of bread and milk, which gave him ſome relief, and in a few days he was able to walk out. I was ſurpriſed when he called at my houſe a week after, but the tumor was by that time increaſed to the ſize of a hen's egg, of a purple color, and the pains very great. I did all in my power to convince him of his ſituation, and urged him to think ſeriouſly of his wife and childrens dependence on him; and he at laſt agreed to be operated next day. I went to his houſe with ſurgeon Kennedy and another at the appointed hour,

hour, but the man was so terrified with thoughts of the operation, that he left his house, and desired his wife to acquaint me, he was much better, and gone out about business. I was amazed at the intelligence, and told her that I could by no means credit what she said. Two months more elapsed, and the tumor and pains having still increased, he was advised to go to St George's Hospital, London. Mr John Hunter proposed to extirpate the eye the very next day, as there was an immediate necessity for it; but the man died that night.

Remarks. It appeared that during the course of ten months, I had foreseen that cancerous case, and it was in consequence of that opinion, that I had advised him to undergo the operation. We meet in authors many observations on cancerous cases of the eye, but we seldom meet with a series of symptoms and their different stages; therefore I have thought this observation of use to young practitioners who may not have an opportunity of this kind.

Anne M'Pherson, about 28 years of age, who lives in Richmond-street, No. 211. applied to me in August 1786 for her right eye. She had been a patient in the Infirmary and Dispensary of Edinburgh. When I saw her first the external parts of the globe were totally covered with varicous vessels, insomuch that there was no distinction between the sclerotica and cornea to be observed; this last coat was particularly so covered, that it had become invisible. She felt no pains, as the disorder was local; the lids and lacrymal points were sound, and her eye watered but little, so that it was, properly speaking, a dry inflammation, as the eye had a red appearance. The other eye was lost in her infancy. I prescribed emollient fumigations for several days, and dressed the eye every other day, with the pommatum

deterſivum, No. XXXII. and ordered her to bathe the eye with a cold emollient lotion, three hours after each dreſsing. She took two or three doſes of phyſic, No. X. more for her health than for the eye. In ſix weeks, I began to diſtinguiſh the cornea; and, on continuing the above dreſſing, but more irregularly, I was enabled to ſee the iris through the cornea, and ſhe ſoon began to ſee objects confuſedly. I let the eye alone for a whole month, and all the blood varicous veſſels which yet covered the cornea became lymphatics; and ſhe was able to read after a month, by the ſame plan of dreſſing, only twice a week. Since I have done no more, nature has finiſhed the reſt, for the cornea is become entirely tranſparent, and ſhe is able to work at her needle.

Remarks. The texture of her cornea was exceſſively good and tranſparent, for that reaſon the varicous veſſels had not been able to penetrate in its ſubſtance; if that ſhould have been the caſe, an hypopion muſt have been the conſequence, and likely the loſs of the organ. I have often obſerved, that the varicous veſſels grow even at the time of dreſſing, and the more numerous they are, the more they become ſo, on account of the lids decreaſing in their functions, for which reaſon the doſe of the dreſſing ought to be regulated according to circumſtances.

CURA-

S

CURATIVE METHODS

FOR THE

INTERNAL DISORDERS

OF THE

GLOBE OF THE EYE.

THE hypopion, a diſorder I have already ſpoken of, (page 86.) is a very common one, and not eaſy of curation. It is now very material to obſerve, that the hypopion, though ſituated in the interſtices of the pellicles in the cornea, is eaſily diſtinguiſhed from the ſpecks and cicatrices, in or upon this tunic, by the following ſigns: The cicatrices are white, and the ſpecks greyiſh; the hypopion, on the contrary, is not only yellowiſh, but always attended with quick and ſhooting pains, violent inflammations in the conjunctiva, wakes, *&c.* However, the ſame accidents happen when a gathering of matter, in the anterior chamber of the globe, is exiſting: but, in this laſt caſe, the matter occupies the inferior part of the ſaid chamber; whilſt, when it is infiltrated in the pellicles of the cornea, the opacity formed by it remains more or leſs oppoſite the pupil.

The cauſe and nature of the opacity of the cryſtalline and its capſule being ſufficiently explained, I will mention now the manner of extracting it out of the globe, when couching is not preferable; as this is very

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often the caſe, when the anterior chamber is not ſufficiently ſpacious to permit the paſſage of the knife betwixt the cornea and iris, without any riſk of hurting this laſt membrane. After that, I will proceed to the explanation of ſuch precautions as I think abſolutely neceſſary one ſhould be perfectly acquainted with, to perform the operation of couching. An operator well experienced and inſtructed ought to know every method. One manner of operating muſt never exclude another, when it may be good and fit for the caſe in hand. Beſides, as it is not poſſible one might foreſee every thing that may happen in common practice, I will omit nothing here, to inſtruct the reader about a diſorder and operation which commonly eſtabliſh the reputation of oculiſts.

If the patient be of a good conſtitution, in health, and cataracted in the right eye only; if the anterior chamber be as ſpacious as commonly, and the cornea ſufficiently convex; if the organ diſtinguiſhes light from darkneſs, and that the pupil contracts and dilates eaſily; it will be unneceſſary to prepare him for the operation, by the uſe of cooling drinks, bleeding, or any other indications, which are only proper when of a ſanguine, cacochymic conſtitution, &c. &c. This well conſidered, the operator ſhall chuſe an apartment as well lighted as he can, but without any appearance of the ſun during the operation; then he ſhall ſhut every window, except that before which he has a mind to perform, and take care to provide for curtains, or window-ſhutters, in order of intercepting the brightneſs of the light when convenient; this being of very great conſequence, as I ſhall demonſtrate hereafter. Let him cover the patient's head with a cotton cap, and tie to it two compreſſes, each of ſix inches long, and three inches and a half large, made with four folds of a very fine and dry linen cloth, to keep each eye from the light: beſides, let the patient

be

be ſeated in an arm-chair, a little raiſed up, and ſituated in ſuch a manner as he may preſent his right ſhoulder towards the ſide of the window; then he will lift up one of the compreſſes which covers the cataracted eye, and tie up its inferior extremity to the cap, leaving the other down on the left eye, in order of hindernig him from ſeeing. The operator pinches the ſuperior eye-lid ſlightly, and raiſes it up with the thumb and index of his left hand; then he takes the *ſpeculum oculi* in his right hand, and places it ſoftly round the globe of the eye, under the eye-lid on the ſide of the external angle. Whilſt the aſſiſtant, (placed behind the patient, to keep the head ſteady, and lift up the ſuperior eye-lid with the index and magnus of the right hand, and at the ſame time ſuſtain it on the coronal with the left hand, in ſuch a manner, as to give himſelf facility with his own arms, to keep the patient's head very firm), the operator takes his knife with the left hand; this done, he brings down the inferior eye-lid with the index of his right hand which holds the handle of the ſpeculum, leans during this time the three laſt fingers of the left hand, which holds the knife, on the extremity of the patient's os mallæ, in bending the magnus whereon his knife ought to be fixed between the nail and extremities of the finger. At the time of the inſertion of the knife into the cornea, at a line from the ſclerotica, he makes a ſoft preſſure with the ſpeculum, in order of hindering the globe from turning towards the great angle, and diſcontinues it in proportion as he finiſhes the ſection. As ſoon as it is performed, that is to ſay, when the ſection is finiſhed, and the knife from the eye, the aſſiſtant ſhall let the ſuperior eye lid come down as ſlowly and with as great precaution as poſſible, during the time the operator replaces the inferior in its natural ſtate; after that, he takes away the ſpeculum.

Now,

Now, to give the patient an opportunity of coming to himſelf, he ought to ſtop for a minute or more if he thinks proper.

To finiſh the operation, the aſſiſtant lifts up again the ſuperior eye-lid with all the precaution above deſcribed, whilſt the operator brings down the inferior, with the index of the left hand; then he introduces the kyſtitome by its ſheath into the globe, to the inferior part of the ſection, obſerving to place its extremity on the cryſtalloida, without touching the iris in going through the pupil. This done, he puſhes the little button of the kyſtitome, with the finger index, to have its blade out of the ſheath; then he inciſes inferiorly, tranſverſally, and, at one cut, the capſule of the cryſtalline, and takes away the inſtrument. He ought to remember, that, at this time, he muſt diminiſh the light, in order to produce a dilatation in the pupil, and facilitate the extraction of the cataract, by the help of ſome ſoft preſſures made under the globe. Theſe preſſures may be done with the extremity of the kyſtitome placed horizontally, or with the fingers; but they ought to be made ſoftly, repeated as long as the cataract remains in the globe, and diminiſh in proportion it goes out of it. To receive this opaque body on the flat part of the inſtrument is a good method. If ſome particles of the cryſtalline body remain under the cornea, he extracts them with the kyſtitome made at one of its ends, juſt as an ear-picker. If after this operation the pupil appears of a blackiſh color, the operator may expect ſucceſs. This over, the aſſiſtant ſhall let the ſuperior eye-lid down, which, joining the inferior, keep the eye ſhut. At this time, the operator will untie the top of the compreſs, and cover the globe with it; in order that both eyes be motionleſs, to facilitate the cicatriſing of the inciſion performed in the cornea; for, if one eye was to move, the other would

would follow the ſame motions, even againſt the patient's will.

When the operator places the ſpeculum oculi round the globe, he ought to employ no preſſure, except when he runs the point of the knife into the cornea; and during the time of the beginning of this operation, he ought alſo to direct its points towards the oppoſite circumference of the pupil, in order of having the facility to countenance the folds of the iris, with the flat part of the knife, in caſe the impulſion of the aqueous humor (occaſioned by the preſſure of the ſpeculum) brings it under its ſharp ſide: for, to avoid the cutting of it, he will find very eaſy by lifting it up, by degrees, in conveying its point tranſverſally, and at the ſame oppoſite part of the cornea. When the knife has gone through the cornea tranſverſally, it is at that very time the ſpeculum oculi ought to make no longer a preſſure, though kept in the ſame poſition till the cornea be opened inferiorly. The inferior part of the iris preſents itſelf almoſt always under the edge of the knife, when the operator puts an end to the ſection; but as its blade is convex on that ſide, he finiſhes it in cutting round, obſerving, however, to do it the loweſt poſſible, in order the diviſion of the cornea be not oppoſite the pupil. I think it is very neceſſary that the patient ſhould be inſtructed in every point which concerns this operation; becauſe he certainly ſhall exert all his abilities to hinder the globe from moving under the ſuperior eye-lid. For which reaſon, he ought to be told, that the above ſituation of the globe facilitates the operation, and that the pains he is to ſuffer are not really as violent as he might imagine.

The dreſſing which follows this operation, is next to be taken into my conſideration, as being attended generally with numberleſs dangerous conſequences, eſpecially when a complication of accidents is exiſting at the ſame

ſame time. As ſoon as the operation is over, the patient ſhall be put to bed in a very dark room, laid down upon his back, the head as low as poſſible, and always ſtraight, that is, his body laid down horizontally; half an hour afterwards let him be bled in the arm, the repetition of which I leave to the judgment of the operator. Every two hours after the operation, he lifts up the compreſſes (but never allows the patient the opening of his eyes, as he would perhaps pay very dear for the gratification of his curioſity) to make a lotion on the exterior part of the eye-lids, with a very ſoft hair pencil dipt in a cold emollient infuſion; then he waits till they are dried of themſelves, to let the compreſſes down, obſerving that they be of no weight over the globe of the eye, as any heavineſs in ſuch a caſe may be very hurtful. He ſhall continue this dreſſing regularly till the ſixth or eighth day, at which time an overflowing of thick matter (but of no bad nature) commonly happens, which is the forerunner of a very lucky ſucceſs: In the meanwhile, the patient muſt be kept to a low and regular diet, and particular care muſt be had to give him a nurſe to watch him during the night, in order to deter him from moving his head when aſleep. After this time is over, he raiſes up a little the patient's head, to refreſh him from the fatigues, and diminiſhes the quantity of the lotions, in proportion he thinks it neceſſary. When the wound in the cornea is entirely re-united, and the cicatrice made, what is aſcertained by no flowing of the aqueous humor, then he allows the patient the opening of his eyes, in the dark, for ten or fifteen minutes, from four to four hours; all this managed in proportion to the time, and according to the diminution of the inflammation; beſides, the patient may be ſeated in his bed, and then go out of it from time to time, till he finiſhes, by expoſing his eyes to the ſtrongeſt light. With theſe precautions,

a deal of trouble and pains, which are commonly attended with a loſs of ſight, are ſaved to the operated.

If every particular above mentioned did go on as well as a deſcription, it would be very agreeable; but as a great many accidents and obſtacles, which puzzle very much a young beginner, happen during the whole time of this treatment, I will now take them into conſideration. The continuation of theſe emollient lotions occaſions commonly a ſlight but ſharp excoriation on and round the eye-lids, and a lymphatic ſwelling in their texture; to get the better of theſe inconveniences, one ought to make uſe as a lotion, of the collyrium, No. XVII. and diminiſh the quantity of emollient lotions when the inflammation preſents no eminent danger.—However, I ſhall obſerve here, that now and then, ſeparately and alternatively, the emollient lotions ought to take place, together with the uſe of the ſaid collyrium. This depends always on the caſes that may require one or the other, by way of preference. All theſe lotions are only practiſed on the operated eye, except two or three upon the other, to mitigate the acrimony of the tears, as this eye remains continually ſhut. Theſe contra-indications ſhow plainly, that the effect of the firſt of theſe lotions is to relax, and the ſecond to bind the parts together.

It happens very often, that the diviſion practiſed in the cornea cannot be joined and united entirely, either by the iris or ſome extraneous bodies being placed betwixt the lips of the wound. In caſe this impediment be produced by any extraneous bodies, they ought to be extracted, and the patient laid down again upon his back, both eyes ſhut, and bathed with the lotions as above, till the running of the aqueous humor be quite ceaſed. If the iris leans on the cornea inwards, and produces a ſtaphyloma; then a ſmall inciſion on the tumor

 ought

ought to take place, avoiding to hurt this vascular membrane, to let the aqueous humor out, and facilitate by this means, the replacing of the iris; and in case this operation does not effect the entire re-uniting of the cornea, the incision must be renewed, and immediately after it, a dose of the ophthalmic pommatum, No. XXXII. for one or two days is required.

The pressure made with the speculum oculi, to fix the globe at the time of the section during the operation of extracting, does not produce an inflammation, as many would imagine. If any one will have a convincing proof of this assertion, let him introduce it in the eye of any body whose eyes are sound; then he will have an opportunity of observing, that the inflammation occasioned by it, will not last more than a quarter of an hour, or half hour, and the whole time without pains. Before to dismiss this paragraph, I will here observe, that when one has to struggle with a staphyloma and an inflammation at the same time, he must pay no regard to this last affection; for, considering two objects which require equally a speedy help, it will depend only upon his sagacity, to judge whether applying a dose of the said ophthalmic pommatum, which increases still the inflammation, be necessary, or not. A practice, grounded upon this theory, will very soon reconcile him to it. In fact, the inflammation diminishes to the third or fourth day, after the application of this remedy; because, being dissecative, it takes off the swelled and varicous vessels, and consequently puts an end to the disorder. This method is just as fire and water, if I may be allowed the expression, which a practitioner ought to manage with the greatest care and ability; for fear, that a more or less quantity of one or the other, may not produce greater accidents than those he intends to remove.

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The operation of extracting the cataract is not always practicable: there are even many cases wherein it would be more eligible to reject it than to admit it. When the extraction is thought impracticable, either because of a small space in the anterior chamber, a defect in the pupil, or an overturning of the inferior eye-lid; then couching ought to be preferred, if the cataract be solid, ripe, and of a common nature. This operation is performed as follows, the patient being seated for that of extracting as above described; the operator places the fore-finger of his right hand on the superior eye-lid, to lift it up, and his thumb on the inferior to keep it down; then he takes the needle with his left hand, betwixt his thumb and fore finger, just as if it were a pen, placed in such a manner as the middle finger be at the upper extremity of the handle, and the fore finger not more advanced than the thumb: this done, he leans the two last fingers on the temple, in order to avoid any shaking of his hand, and bids the patient turn his eye towards the nose; at that very time he sinks the needle into the sclerotica, at one line from the limb of the cornea, on the side of the external angle, endeavouring to shun the varicous vessels, if some appear at the very place of the insertion of the needle. When it is arrived opposite the pupil, he turns it by half, and directs its flat part upon the superior part of the crystalline, which he brings down under the pupil, in attempting to fix it there: after that, he sets his needle horizontally, and gives it a half turn, to take it out as it went in, in order that it may wound no other part.

If an effusion of blood into the globe happens, when the needle has been run through the coats, and that the aqueous humor be troubled in such a manner as to hinder from seeing in the back chamber, before the depression of the opaque body, then the operator shall take

away his inſtrument, and proceed no further till that effuſion of blood be entirely reſolved by the uſe of ſome emollient fumigations. If the cataract, when couched, happens to replace itſelf in the foſſula of the vitreous body, either totally or part of it, jumping may be recommended at different times, when the patient is quite recovered; for though ſuch a method may appear ridiculous at firſt, yet ſeveral phyſicians have obſerved, that it proved ſometimes beneficial, eſpecially when no adherence has been contracted; and in caſe this does not ſucceed, it ought to be couched a ſecond time with the needle. There are, however, a great many circumſtances wherein either of theſe methods is quite uſeleſs; but, as I propoſed them only in caſe the other cannot be practiſed, an operator ought to make the moſt of them, without any further wiſhes. Before to wind up this paragraph, I think it will not be improper to remark here, that a cataract couched to the bottom of the globe, does not diſſolve, as has been thought by many writers. For the ſupport of this opinion I have ſeveral inſtances, three of which no body, who reads the medical and chirurgical journals for theſe twenty years laſt paſt, will doubt. Three perſons, at different times, died in the hoſpitals of Paris: they were remarked by the ſtudents, and their eyes opened before a numerous aſſembly, who all ſaw the opaque bodies adherent to the bottom of the globe, though lodged there for ſeven years in the firſt, thirteen in the ſecond, and ſeventeen in the laſt. However, I muſt obſerve here, that its diſſolution will certainly take place, if the cryſtalloida is properly tore; this has been remarked by Mr. Pott and myſelf. I have attempted to tear the cryſtalloida without couching the lens, and let it diſſolve without any further trouble; but having been diſappointed five times in ſix operations, I have entirely given it up. The method I practiſed for that purpoſe

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was this: A common couching needle was run through the cornea at a line from the circumference, then directed through the pupil diagonally, and then on the anterior face of the cryſtalloida, which was tore as much as I could find it convenient; this kind of operation I termed *detrition*. As to the whole and ſound cryſtalline, well wrapt up in its membrane, I think it would take more than a man's life-time, for its diſſolution in the globe of the eye.

The foundation of our knowledge in the art of healing is juſt and exact anatomy: without ſuch a help, the practitioner acts as in a maze, is apt to go aſtray, and make blunders every minute. It is allowed on all hands, that, for want of a due theory in the art, he produces many more accidents, and of greater conſequence, than the diſorders he pretends to cure. According to theſe notions, every reaſonable man who follows the medical buſineſs, ſhall freely grant, that he cannot examine too cloſely all the parts which the human body is compoſed of, in order of becoming well acquainted with the ſtructure, extent, limits, and adherences they have with thoſe nearly related to them. It is on account of theſe conſiderations that I have thought neceſſary to lay down a long and particular detail upon the cryſtalloida, as a great many anatomiſts differ very widely about the nature of this capſule; through it paſs a great many lymphatic arteries, which penetrate into the ſubſtance of the cryſtalline lens for its nutrition, and to ſuſpend it in morgani humor, or elſe the cryſtalloida ſhall turn opaque, by becoming in contact with this capſule. When the cryſtalloida is properly inciſed, ſometimes theſe lymphatic arteries detain the cryſtalline lens, and may give a ſuſpicion to the operator that its capſule is not fairly inciſed. This has happened to me ſeveral times, and I diſcovered

difcovered it to be particularly fo when the cryftalline lens was rather fofter than ufual.

The cryftalloida is made up of two fpherical and concave membranes; the pofterior lines the foffula of the vitreous body; the anterior is lefs extent and concave than the pofterior; but the firft is thicker than the laft: befides, they are united together by their neighbouring edges, as it will be further demonftrated hereafter than it has above. Almoft all the anatomifts have advanced, that the cryftalline has a particular envelope, which is covered with the capfule of the vitreous body. Experiments, however, fpeak to the contrary; for it is a fact fufficiently cleared up, that the cryftalline lens has but one, and which ftands by itfelf. The opacity, to which it is fubject, being fo vifibly fixed as not to be able to extend further than the anterior or pofterior circumference, was a fufficient reafon to make practitioners underftand, that in cafe this envelope had been an extenfion of thofe of the vitreous body, thefe fhould have been more or lefs affected along with it. Befides, if they had enquired and affigned a phyfical caufe, why a cataract precipitates itfelf to the bottom of the chamber of the eye, without any help of art whatfoever, they would have undoubtedly forefeen, that the membranes of the vitreous body do not wrap up the cryftalline; for, fuppofing this envelope had exifted, how could it be poffible to conceive, that the cryftalline body would naturally and of itfelf go out of its place?

What I have to fay concerning the cryftalline capfule requires a particular order, and will be divided into two parts. The firft fhall contain different experiments, to demonftrate, *1ft*, That the cryftalloida is the fingle cryftalline's envelope. *2dly*, That this kind of bag is only contiguous to the tunics of the vitreous body. *3dly*, That it is made up of two calottes, adapted and contiguous

guous to each other, in the whole extent of their limbs. The ſecond ſhall incloſe many obſervations to bring theſe truths to a ſufficient light, to which ſome analagous reflections on that head ſhall be added. Moreover, I will deſcribe the cauſes that determine the total, or part, of the cryſtalloida's opacity, together with the propereſt means fit to check this diſorder, or re-eſtabliſh the organ whoſe ſight might be impaired by it.

Firſt Part. Let one perform a circular ſection in the cornea of the eye (when extracted out of its ſocket) of an ox newly killed, and introduce, through the pupil, the ſmall handle of an inſtrument, and direct it obliquely towards the very circumference of the foſſula, till it be arrived there. Let him ſeparate ſoftly the cryſtalloida from the vitreous body, with ſome ſmall pullings or ſhakings, from right to left, *et vice verſa*. As ſoon as the baſis of the proceſſus ciliaris ſhall no longer reſiſt to the effort of the inſtrument, let him introduce it into the foſſula, in turning, and leading it in ſuch a manner, as to paſs under the two thirds of the circumference of this cavity, to deſtroy the adherences which are to be met with, between the cryſtalloida and the vitreous body. If he places on the cryſtalline capſule a buttoned probe, he will have an opportunity of obſerving, that there is no fleating portion of the membrane to be found. This furniſhes a convincing proof, that the extenſion of the capſule of the vitreous body does not exiſt over the cryſtalloida. Let him overturn the eye, and pay attention to the few adherences there are between theſe two tranſparent bodies, as the point of their union is only exiſting in the circumference of the foſſula of the vitreous body; let him ſeparate them from each other, and put the cryſtalloida on a white ſheet of paper; then, with the help of a good microſcope, he will ſee the moſt exact poliſh all over its ſurface; in ſhort, he ſhall remark, towards

wards the circumference of the cryſtallo-anterior, ſome ſmall grooves very near each other, and that every one of them have about the third of a line in length: their function is to keep faſt and ſteady the baſis of the ciliary fibres. If ſome remain ſtill, let him take hold of them with a pair of ſmall tongs, they will give way to the ſmalleſt effort; and he will find, by looking with attention, that a great many lymphatic arteries, though ſmall and delicate, are prolonged till their tunics will give way to the pulling, and be broke. If the cryſtalline capſule were an expanſion of that of the vitreous body, it ſhould naturally reſult from this, that a blunt inſtrument, ſuch as a handle, could not well divide the tunic by tearing. Moreover, he will further obſerve, over the cryſtalline capſule, when taken out of the foſſula, an exact continuity near all the edges, which could not be performed by the moſt ſharp inſtrument. Beſides, if the cryſtalloida were not a particular envelope of the cryſtalline body, it would not be poſſible to divide it from the vitreous body with the handle of an inſtrument, without producing ſome inequalities; but, as a gradual preſſure is ſufficient to ſeparate the two tranſparent bodies from each other, it follows neceſſarily, that one needs neither ſharp nor flat inſtruments to perform a circulary diviſion.

Let one cut circularly the middle part of the globe of an eye, that is, at about three lines from the limb of the cornea, without touching either the vitreous body, or the cryſtalloida; let him ſeparate theſe tranſparent bodies, from the other tunics of the globe, and put them aſide upon a clean plate, he ſhall ſee that the cryſtalloida is a great deal more denſe than that of the vitreous body. If he thinks that the oculary lens makes its capſule look thicker than it really is, let him touch ſlightly over the vitreous body with a buttoned probe, and pay a proper attention to its elaſticity in compariſon

parifon to that of the cryftalloida, he will have an irrefragable proof of what is advancd above. To perform all thefe experiments, one ought to prefer the eye of an ox or horfe to that of a man; becaufe the parts of the firft being more volumnious than the laft, one may diftinguifh them a vaft deal better. Moreover, the cryftalloida in thefe animals does not differ in the leaft from that in the human eye, except by its greater bulk. However, the above experiments practifed on the human eye fhall certainly produce the very fame remarks, provided one can diftinguifh as well.

To complete the above experiments, one ought to open, with a fmall pointed chirurgical inftrument, the cryftalloida feparated from the vitreous body, and, after its removal, take them deprived of the fluid, betwixt the fingers feparately; he fhall feel by the touch, that the cryftalloida is thicker than the two tunics of the vitreous body; then let him bring thefe tunics near a hole practifed in a window fhutter, through which pafs fome rays of the fun, he will have an opportunity of obferving a multitude of pores, fpread over the whole texture of thefe membranes; with this difference only, that the cryftalloida has lefs of them than the tunics of the vitreous body. What then may be the caufe of the difference that one remarks in the thicknefs and foftnefs which are to be diftinguifhed in thefe envelopes? It is becaufe they are of a diftinct nature. Befides, let him mace:ate the globe of an human eye into fome brandy, he will remark, fome few days after, when he comes to cut it open, that the cryftalloida has acquired an opacity fimilar to that which occafions the cataract, whilft the membranes of the vitreous body will keep their natural tranfparency. Let him fink a tooth-picker, by its point, betwixt the cryftalline capfule, and that of the vitreous body, and cut the opaque body, to feparate

it from the foſſula, he will find, that the poſterior face of the cryſtalloida has acquired the ſame degree of alteration as the anterior. He may naturally conclude, after this experiment, that had the cryſtalline capſule been an extenſion of that of the vitreous body, this laſt membrane would have participated to the loſs of tranſparency in the firſt; but as this alteration has not been the conſequence, it is a very clear proof, that the cryſtalloida is only contiguous to the vitreous body. He will ſee, moreover, that the cryſtalline capſule is formed by two ſpheroid and concave tunics, when he performs the following experiments.

Let the cryſtalloida be ſeparated from the vitreous body, and macerate in a little phial full of common water, within a few days afterwards, he will have an opportunity of perceiving that this envelope is opened in its lateral part. Let him take it out of the water, and divide it, ſetting aſunder the diſunited parts from each other, he ſhall ſee, that the cryſtallo-poſterior is more extent and concave, but leſs denſe than the cryſtallo-anterior.

Let him perform an inciſion, ſufficiently large, in the cornea of a living animal, and ſqueeze the eye by degrees, till the cryſtalline goes out of its envelope, without cutting into this laſt membrane, then he may remark, at the time of the preſſure, a great tenſion in the whole capacity, eſpecially towards the anterior part, and will eaſily conceive, that the vitreous body, by its elaſticity, operates at this very moment a compreſſion over the cryſtalloida, which is much the ſame as that performed in the external parts of the globe. Let him diminiſh the preſſure at the ſame time of its going out of the foſſula, in order of obſerving the demi-circuit formed on the limb of the cryſtallo-anterior, then the cryſtalline will no ſooner be extracted, than a miſt, which did not

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exiſt before, ſhall appear beyond the pupil. Let him ſqueeze ſufficiently the globe of the eye with the fingers to extract the vitreous body, he will eaſily obſerve, that the cryſtallo-anterior is become opaque in its whole extent, whilſt the cryſtallo-poſterior has kept its tranſparency as well as the vitreous body. The dilaceration continually operating at the inferior junction of the tunics of the cryſtalline's capſule, proves clearly, that they are only contiguous; and the opacity which happens in the cryſtallo-anterior, during this experiment, is a complete proof of it. It is very material to obſerve here by the way, that if this tunic loſes its diaphaneity when dilacerated, it keeps alſo its tranſparency when an inciſion is practiſed to facilitate the going out of the cryſtalline: therefore, according to this remark, I think one will be ſenſible how neceſſary it is to make a large inciſion in the cryſtalloida when he extracts a cataract. For want of ſuch a precaution, he commonly occaſions a ſecondary cataract, which, as I have obſerved, is difficult to remove.

Second Part. I was preſent when a blind lady underwent the operation of the cataract by extraction. As ſoon as the ſection was performed, the aqueous humor ran down; and, in proportion, the cataract made its way out. It forced open the circulary fibres of the iris. The ſection had hardly been finiſhed, that the cataract went out, and precipitated itſelf on the cheek. We were very much aſtoniſhed to ſee that this opaque body was exactly round, and its circumference neither gummy nor lenticulary as the ordinary cataracts. It was as ſoft as a bag full of water, and kept an hydatide form. When it had been put upon a ſheet of white paper, the other eye was operated and produced the ſame kind of cataract, but of a globulous form. We made a cloſe examination of theſe two opaque bodies,

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and obſerved, with a microſcope, that their ſurfaces were as poliſhed as a looking glaſs: it was not even poſſible to diſtinguiſh their poſterior part from the anterior, nor to perceive the little excavations or grooves, wherein were placed the baſis of the fibres of the proceſſus ciliaris. After having cut open one of theſe opaque bodies, we then ſaw that the cryſtalloida opened, produced a mucuous and yellowiſh matter, which ſpread itſelf over the paper. We obſerved alſo, that at the very inſtant the cryſtalline's capſule was divided or inciſed, that it ſunk over the opaque lens, and had more conſiſtence than in the natural ſtate. One of us preſſed over ſeveral places of the ſurface of the capſule of the ſecond cataract, which always gave way to the preſſure of the inſtrument; but as ſoon as the impreſſion was not ſenſibly diſcovered on that tunic, the comprimated part re-eſtabliſhed itſelf in its firſt ſtate. He performed upon this opaque body the ſame inciſion as the above, but there was no different remark worth making.

I have extracted two cataracts of the ſame nature as the above, except that they were more voluminous and of a milky white color. When I ſqueezed on any point of their ſurfaces, (for I put them on a ſheet of paper) I obſerved a fluctuation to the very lateral parts; and when I finiſhed preſſing upon them, the globulous bodies re-eſtabliſhed themſelves. As ſoon as I had performed the inciſion in the firſt cryſtalline, a whitiſh and mucuous humor ran out of itſelf, and wetted a pretty good extent of the paper, though the diameter of the opaque body, which, of whitiſh and round as it was, became lenticulary and olive-colored. I took up the cryſtalloida, and found it opaque in its whole extent, and thicker than in its natural ſtate.

The ſecond cataract offered quite the ſame remarks as the firſt. There is no doubt that the ſphericity of theſe

these cataracts was only occasioned by the crystalline capsule, and mucuosity they contained. These are also irrefragable proofs that the crystalloida stands by itself, and that it is not, as was believed, wrapt up exteriorly with the capsule of the vitreous body. If the crystalloida and its contents did not sometimes exfoliate, a cataract could never fall of itself to the bottom of the posterior chamber by a violent commotion; but as we meet with a good many instances of that kind, we cannot reasonably refuse ourselves to evidences.

A young man, born blind, with two cataracts in his eyes, had the advice of several oculists, who told his friends, that nothing but the operation of extracting was capable to restore him his sight; but as he was a very boisterous boy, no one of them dared to operate him, considering that he was able to find his way; insomuch, that he remained deprived of sight till he was fourteen years of age, when an unexpected event procured it him. One day, as he was going out for a walk with some other boys, one of them, as they were strolling about in the fields, discovered a nest of birds on a very high tree, and immediately acquainted his companions with his discovery. Our blind boy being senior, and the most nimble that way of them all, desired he might have the glory to climb up to it. He had no sooner reached at the branch where the nest was lodged, than, having lost his equilibrium, he fell from branch to branch, till he came to the ground straight on his legs. This fall freightened him in such a manner, that he lost his senses for a while, and measured the ground with his whole length by a second fall. As soon as he was come to himself, he told his companions, who were freightened on account of his fall, that he saw several bodies in motion, and assured them, to their no small surprise, that he was seeing several objects which

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he was totally unacquainted with. Being returned home, ſurgeons were immediately ſent for, to know if they might expect a happy continuance with regard to the boy's eyes. They all agreed, that the cataracts, which they had ſeen before in his eyes, had totally diſappeared, and were lodged, very likely, at the bottom of the eyes.

Such an obſervation ſhall certainly be no advice for people afflicted with cataracts, to repeat the ſame experiment. This is too obvious for a ſingle proof, that the cryſtalloida ſtands by itſelf, and that cataracts of that kind have their degree of maturity.

In fact, if the cryſtalline capſule had been ſtill adherent to the vitreous body and proceſſus ciliaris, (as in the natural ſtate) would it have been poſſible, though the commotion had been more conſiderable, that the cataracts had precipitated of themſelves to the bottom of the poſterior chamber? Certainly not. It is very natural to think, that, at the time the boy took this lucky fall, the cryſtalloida were almoſt exfoliated from their foſſula, as I ſaid before; ſo that the commotion determined the cataracts to come down, being beſides accellerated by the ſpecific gravity of the occulary lens. One cannot ſuppoſe here, that the pretended portion of the capſule of the vitreous body was tore by the means of the commotion; for, though the ancient anatomiſts thought it did wrap up the anterior portion of the cryſtalline, it is very eaſy to refute ſuch an idea by what follows, and many other aſſertions of as ſtrong and powerful arguments as thoſe here mentioned. Could it be poſſible, that a commotion were capable to dilacerate a membrane, as that of the vitreous capſule, without any ſuch raptures in the ſoft and thin veſſels of the brain, and other parts of our body, whoſe texture is as delicate? Could any one imagine that Nature herſelf, being

ing tired of blindneſs, determined the commotion and dilaceration of the vitreous capſule; in order that the opaque bodies might be precipitated the eaſier to the bottom of the globe, whilſt ſhe would have preſerved the other parts of this organ? Indeed, this would have proved a very extraordinary phœnomenon! But an objection preſents naturally of itſelf to remove ſuch a ſtrange idea. Suppoſe the vitreous capſule ſhould ſtretch itſelf to the very anterior part of the cryſtalline, and that it were dilacerated on account of the commotion, it would naturally follow, that this part would loſe its oſcillation, from thence an obſtruction in the veſſels, a ſtagnation of their fluids, and an opacity of this envelope. After all theſe conſiderations, one may reaſonably conclude, that the vitreous body was not altered in the leaſt at the time of the removal of the cryſtalloida, and that this laſt membrane is the only envelope of the cryſtalline.

I was preſent when a young girl, born blind, underwent the operation of the cataract by extraction. The operator had no ſooner opened the cornea and cryſtalloida of her right eye than a milky humor came out of the globe. When this fluid was entirely run out, we obſerved, beyond the pupil, an opacity in the cryſtalloida; but it was impoſſible to extract it, as the vitreous body produced a great quantity of its fluid, and experienced a viſible ſinking. The operator proceeded to the other eye, but did not open the cryſtalloida in order to extract it along with the cryſtalline; for the effect of which he introduced through the pupil, immediately after the opening of the cornea, an inſtrument, made at its end juſt as an ear-picker, and directed it towards the inferior portion of the foſſula of the vitreous body, in order of deſtroying the adherences that contracts its capſule with the cryſtalline. As ſoon as the inſtrument's end was in the interior of the foſſula, he tore the cryſtalloida, out

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of which flowed a viſcous and milky humor, and produced the exfoliation of it. The interior of this tunic contained not the leaſt remain of the cryſtalline body, for which reaſon we conjectured it was liquified. If the cryſtalloida had been a continuation of the vitreous capſule, could it have been poſſible, that, by ſingle touchings with the inſtruments, its exfoliation had taken place without a dilaceration to the circumference of this cataract? As none was exiſting, it is a convincing proof the cryſtalline capſule is independent of the vitreous's, and that it ſtands by itſelf.

Several phyſicians were called for their advice in a cataracted caſe, among whom I was one. We remarked, that the bulk of the cataracted eye was equal to that of the ſound one: the pupil of the firſt was not only dilated, but immoveable to all degrees of light it was expoſed to; a ſure token of the complication of a perfect blindneſs. The cryſtalline looked opaque, and floated at the leaſt motion of the globe: its whole ſurface was wrinkled, and leſs volumnious than the common cataracts. The poſterior part of this opaque body was pyramidal, and only adherent to the ſuperior part of the ring of the foſſula. The vitreous body was tranſparent, its foſſula appeared convex, and the aqueous humor limpid; in ſhort, this eye was affected with a moveable and looſe cataract. We aſked him whether he had received any blows on his eye, or undergone the operation of couching; he anſwered in the negative, and added, that the diſorder had occaſioned neither pain nor inflammation. If the cryſtalloida were covered over its anterior part by a lengthening of the vitreous capſule, how could the cryſtalline body, with its capſule, have got out of the foſſula without exterior cauſe? The ulceration in the cryſtalloida is always attended with an extreme contraction in the pupil, and adheren-

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ces contracted between the posterior faces of the iris and the crystallo-anterior. The accidental displacing of the crystalloid body proves, *1st*, That this cataract has a maturity which consists in the exfoliation of the crystalline capsule. *2dly*, That this envelope is not a continuation of that of the vitreous body. The following observations are further proofs and instances of it.

I have extracted a cataract out of the right eye of a gentleman who was of a very good constitution, and afflicted with no other disease. The opaque body was of a white pearl colour, and floated at the least motion of the globe. As soon as the section in the cornea was finished, I compelled (with a blunt instrument) the opaque body to an exfoliation, to have it out of the globe. The sight was re-established that very instant, and the treatment, after the operation, was carried on without accident. The crystalline was wrapt up with its capsule, but both were opaques; with this difference only, that the crystalline lens was of an olive colour, and the crystalloida of a pearl color. This envelope was a great deal thicker than in the natural state, and no remains of a dilaceration were to be distinguished upon any part of its surface. I chose to exfoliate this body with such an instrument, because I conjectured it was not fixed in its fossula, as it appeared quite loose in its greatest extent.

About ten years ago, I was called to give my advice for a young man, who had from his birth two cataracts in his eyes. They were of so singular a nature, and so very uncommon, that no body chused to extract them. When the young man directed the axis of his eyes downwards, the cataracts rose up of themselves, and the third inferior part of the pupil was quite discovered; but if the globes were fixed horizontally, they came down and obstructed the pupil. Thus the young man

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was only able to ſee his way; and, as I ſaid before, when the axis of his eyes were directed downwards. Though theſe cataracts had a kind of elaſticity, and ſomething extraordinary in themſelves, I judged their extraction practicable, having remarked the pupils ſuſceptible of contraction and dilatation, and the ſound ſtate of the globes. As ſoon as I had practiſed the ſection in the cornea, the aqueous humor ran out as uſual, and, at this very inſtant, the cataract changed its poſition. This lenticular body having been conſtantly fixed oppoſite the pupil, as long as the globe was horizontally ſituated, raiſed up for the firſt time, and its inferior limb found itſelf towards the middle of the pupil. I preſſed ſoftly under the globe of the eye, to oblige the opaque body to go through the pupil; but having obſerved that the vitreous body preſented itſelf, and that the cataract had almoſt entirely hid itſelf under the ſuperior part of the iris, I altered my way of operating, by taking hold of the opaque body with a pair of ſmall tongs, and extracting it out of the globe, I ſucceeded as well as I could wiſh. This over, I undertook the operation on the other eye, which produced the ſame remarks, except that the cataract divided itſelf in two portions. I took hold of the inferior, which was the moſt conſiderable, and brought it out, whilſt the other went towards the top of the globe, juſt in the ſame manner as a venitia-blind let looſe to the ſtrength of its ſpring. What is moſt extraordinary in this is, that after the complete cure of this patient, I could not ſee any portion of the cataract which remained behind, having taken its quarters, as I ſuppoſe, to the ſuperior or inferior part of the globe. Theſe two cataracts were cryſtallines and capſullaries: their form preſented a ſpheroid more flat than the common ſort. What might be the cauſe of the mobility of the above cataract? To this I anſwer,

ſwer, that they moved of themſelves, becauſe the cryſtalloida were exfoliated to their inferior and lateral parts, whilſt their ſuperior were ſtill adherent to the circle of the foſſula of the vitreous body; ſo that, when the axis of the eyes were bent downwards, the inferior muſcle of each globe being in action, occaſioned in this part of the organs a point of compreſſion capable to change totally the form of the foſſula of the vitreous body, and give it a conical figure. The aqueous humor of the poſterior chamber, having in this ſituation of the eyes a great deal more facility to paſs in the anterior chamber, ſhook the inferior limb of the cataract; and being compelled there by the convexity of the foſſula, it produced a change in the ſituation of the opaque body, by placing it backwards, and opening a way for the rays of light, which left each organ a power to ſee ſome objects: when, on the contrary, the globes aſſumed an horizontal poſition, the preſſure of the inferior muſcle not exiſting, and the aqueous humor exerciſing a ſufficient preſſure over the vitreous body, obliged its anterior part to re-aſſume a concave form; then the edge of the foſſula came forwards, and the cataracts did fall down where they were before. In this ſtate, the luminous rays were intercepted, and the perceptions ſuſpended. What confirms me more in this opinion is, that the aqueous humor had no ſooner been evacuated, after the inciſion in the cornea, than the cataract raiſed itſelf up, though the axis of the eye remained horizontal; becauſe then, the vitreous body being no more kept cloſe by the action of the aqueous humor, its elaſtic ſtrength altered immediately the form of the foſſula, which from concave became convex, and compelled, by this means, the opaque body to change its poſition. Therefore, after having well weighed the caſes, when a cataract is floating, an operator ſhall never

open the cryſtalloida to extract it; becauſe this envelope, in ſuch a ſtate, is commonly opaque.

Having extracted a cataract out of the eye of a girl, I obſerved, during the operation, that the cryſtalline went very eaſily out of the globe, by the help of ſome ſoft preſſures under it, after I had performed the ſection in the cornea; but, as ſoon as this was over, I ſaw beyond the pupil, an opacity in the anterior part of the cryſtalloida, which I extracted with a pair of ſmall tongs, and brought it out with the uſual precautions. Theſe conſiſt in pulling gently from left to right, and from right to left, as I have already obſerved in the above paragraphs: For, with ſuch precautions, the operator allows a proper time to the adherences which fix this tunic, to ſeparate from the vitreous body. The above remarks have convinced me, that the cryſtallo-anterior may become opaque, while its poſterior keeps its diaphaneity; and that this envelope muſt be made up of two membranes, one ſometimes altered when the other is ſound.

It is not ſufficient to know with certitude, that the cryſtalloida is ſuſceptible of opacity before or after the diſplacing of the oculary lens; it matters yet to know the cauſes for which it loſes its natural ſtate: The internal are, 1*ſt*, an alteration of the morgani humor, as I have already obſerved. 2*dly*, The obſtruction in the veſſels of this envelope, and the dilaceration in it, which all contribute to form its opacity.

The external cauſes are, 1ſt, blows on the globe of the eye. 2dly, A too ſmall inciſion in the cryſtalloida, when one operates the cataract by extraction; becauſe a very little aperture not giving eaſily an opportunity to the cryſtalline body of going out of its envelope, it tears the ſides and edges of the inciſion when the operator preſſes under the globe of the eye to hurry its paſſage; from

from thence a dilaceration or bruiſe, which is ſufficient to opacify this tunic. It is abſolutely neceſſary to pay the greateſt attention to the performing of the ſection in this capſule, and not to preſs under the globe of the eye, but when the inciſion is performed, and ſufficiently large to let the cataract out. Without this eſſential precaution, one runs not only the riſk to produce a ſecondary cataract, but a violent inflammation, or occluſion of the pupil. This laſt accident would be the moſt dangerous, as it ſhould require another operation, more delicate than any one elſe, to re-eſtabliſh the ſight; I mean the perforating an artificial pupil. In performing a too ſmall inciſion, and in preſſing under the globe at an unſeaſonable time, the operator determines the melting of the globe, and its ſinking in the orbit.

All theſe details, whoſe principal aim is to inſtruct the young beginner, are not always ſufficient to acquire a perfection of practice in this branch of ſurgery: Every diſorder produces new phœnomena to the obſervers who have even a moſt extenſive one. When the ſection in the cornea, and the inciſion in the cryſtalloida, are performed to extract a cataract, the operator cannot yet poſitively ſay, if this capſule be opaque, unleſs the cryſtalline be out, or the cataract floating. If the anterior part of the cryſtalloida be eaſy to take hold of with a pair of ſmall tongs, and that after its extraction, the cryſtallo-poſterior be intimately tied on the foſſula of the vitreous body, every prudent practitioner ſhall let the eye remain in this ſtate.

I have read an obſervation in a pamphlet, very well authenticated, that a man having undergone the operation of couching without ſucceſs, was afterwards operated by extraction with ſucceſs. What can be the reaſons why couching could not anſwer the operator's views in that caſe? Becauſe the cataracts were milky, membranous,

membranous, and did not yield under the needle. Here are the abſtracts of both ways. The patient underwent couching five times upon one eye, and three on the other, without the operator being able to bring them down, nor even to tear the cryſtalloida, whoſe exiſtence he was very likely ignorant of. The operation by extraction was as follows: As ſoon as the ſection in the cornea and inciſion in the cryſtalloida were performed, a milky humor ran out, and nothing elſe remained but the opaque cryſtalloida: the operator being prepared for the event, he introduced a pair of tongs in the globe, took hold of the capſule with the extremity of this inſtrument, and, by the means of ſome gentle pullings from the right to the left ſide, extracted it entirely out of the organ. The other cataract produced no different remarks, except that the operator not being able to extract the poſterior part of the cryſtalloida, after an attempt of a whole half hour, he gave it up.

It is not ſo difficult to acquire a certitude of the adherences which contract reciprocally the iris with the cryſtalloida, as to prognoſticate that a cataract is arrived to a degree of maturity. When one has ſucceſſively expoſed a cataracted eye to a ſtrong and weak light, and that the patient diſtinguiſhes day from darkneſs, he may hope for ſucceſs, though the pupil be immovable, by being adherent to the cryſtalloida, if the operator be able to deſtroy them, and ſurmount all theſe difficulties. Theſe adherences of the iris to the cryſtalloida, are always deſtroyed with a ſilver blade, curved on its flat, as this cannot hurt the iris to its circulary part. I will, however, obſerve here, that the pupil may be immovable without any adherence, as I hinted before, by a paraliſy in the muſculary filaments of the iris; for which reaſon, one cannot reaſonably hope of re-eſtabliſhing the

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visual organ, as this is what we generally call a complicated cataract, and of a very bad sort.

After what has been said, I may reduce and bring the cataracts into five classes, without including their complications and variations. The first consists in the single opacity of the crystalline, and may be looked upon as the most frequent: besides, it is not of the same color nor consistence in all men: it is whitish and like curdled milk, till 25 years of age; on the contrary, from that age till the end of life, it is solid, and of a yellow more or less deep; in short, the crystalline may become ossified. The second is a complication of opacity in the oculary lens, with that of morgani humor and crystalloida: it has in most men a solid or liquid consistence. The third is occasioned by the single alteration in the anterior portion of the crystalline capsule. The fourth depends only on the loss of the transparency in the tunic which lines the fossula of the vitreous body; in short, the fifth is produced by the thickening and opacity of morgani humor without any alteration in the crystalline lens.

The reader ought to have remarked in the above observations, that all these sorts of cataracts require some particular manner of operating. He will have many an opportunity of observing, that patients in general, give a great deal more trouble, through their indocility, than the disorders themselves.

The operation of a cataract, by extraction, may also be performed in opening the cornea vertically and inferiorly; but it is attended with so many inconveniences, that I do not advise its practice. The method, such as that I have proposed, is attainable without a great practice, as the fixation of the globe is the main point; but I must allow, that the performing of it in opening the cornea transversally, and without a speculum oculi, re-

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quires more dexterity and practice than a surgeon can acquire. I make no doubt, that an operator who does consider this, will save many a one from blindness, though he might claim the greatest praise by it, on account of his dexterity. However, if any one has a mind to operate constantly without a speculum oculi, I advise him to have the blade of his knife a great deal narrower than common. The operation of the cataract by extraction has another advantage over all others when it is practicable; and this advantage consists in all removal of doubts whether the cataract be ripe or no, whereas in couching, it must be ripe or hard to resist the needle, or else every operator knows the disappointment; consequently, let the lens be soft, hard, or even milky, there are no objections to extraction, and do not produce any material consequence for the success of the operation.

All that needs of an oculary demonstration, requires in that of a typography, some very long and often very tedious dissertations. Those medical gentlemen who have made a particular study of the disorders of the eyes, and acquired an extensive knowledge in them, must allow, that nothing is so varied and difficult of description as the signs and symptoms of the internal maladies of the globe of the eye; besides, it is a very hard case to point right at their curative indications, and account, by physical reasons, for the state of the patient and that of the disorder. As I have already given a description of the symptoms of the cataract and glaucoma, I shall now mention their difference, in attempting to enlarge upon this knowledge by observation, and show what a practice, founded on physical laws, may furnish.

Observation. A gentleman about forty years of age, begged that I would look at his eyes, previous to any account from him; in order he might know whether I could

could, or not, diſtinguiſh the real ſtate of his eyes and ſight, as no body had been able to give him ſatisfaction in this particular. As ſoon as I had cloſely examined his right eye, I told him that he could not poſſibly ſee well enough to diſtinguiſh objects, though he might ſee his way with it: As to the other eye, it was ſound. I obſerved, that the right eye was exteriorly ſound: that interiorly, the pupil contracted and dilated perfectly well when the eye was expoſed ſucceſſively to a ſtrong and weak light. Being well acquainted of the poſſibility of a blind ſtate, though a contraction and dilatation in the pupil might be exiſting, I endeavoured to diſcern the one from the other, by inſpecting the ſtate of the humors and membranes which contain them.

To be brief, I diſcovered a kind of whitiſh pellicle, placed immediately after the poſterior part of the cryſtalline, and directly conjectured, that it was ſufficient to intercept the rays of light. However difficult the caſe was, I ſuppoſed the ſeat of the diſorder to be rather on the cryſtallo-poſterior, than on the capſule of the vitreous body, as the opacity was in ſome reſpect perceptible. What might be the cauſe of the extreme contraction in the pupil of the left eye was a very curious and proper enquiry. I conjectured that the ſtrait fibres of the iris were undoubtedly a great deal longer than the circulary; becauſe a dilatation took place, in proportion as the eye was deprived artificially of the ſtrength of the rays of light. This opacity came on in the following manner: The gentleman happening to walk expoſed to the ſun, and when it was a very ſultry day, experienced at once a great heavineſs over his eye-brow, and in the internal parts of the globe of the eye and its ſocket. He imagined he was preſented with a piece of clear gauze before his eyes; but having rubbed it along with the imaginary object, he became conſcious that

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ſome internal cauſe obſtructed the ſight of this eye, which remained in the ſame ſituation ſince.

Remarks. If ſuch a diſorder be ſo ſingular in itſelf, I think it will not be amiſs to lay down the cauſe, as the ſame may be met with. Its beginning could be nothing elſe but the conſequence of a ſlight inflammation, which was fixed on that part, and produced an obſtruction in the excretory pores and lymphatic arteries of this capſule. I apprehended, that, had the eye been fumigated with emollient infuſions, the obſtruction would have been diſpelled, eſpecially had diluent drinks been alſo made uſe of at the ſame time; becauſe, in ſuch caſes, the ſtagnation of the lymphatic fluid, not being remedied at firſt, an opacity over ſuch thin pellicles muſt abſolutely be the never-failing conſequence.

Observation *read at the Royal Academy of Surgery of Paris, in June* 1775. A gentleman, aged about forty years, of a very ſtrong but cacochymic conſtitution, who had been for a long while afflicted with ſeveral complicated diſorders at the ſame time, through irregularity and the ignorance of different Quacks, called for my advice. Having examined his eyes, I found them ſound exteriorly, and obſerved, interiorly, that the pupils did contract and dilate perfectly and equally; that two ſpherical globules of air were floating in the anterior chamber of the left eye, and that the globe was not at all atrophied. Theſe obſervations being made in a very light room, I renewed them in a dark one, to know whether I might have the very ſame reſults; but, upon the trial, and to my no ſmall ſurpriſe, I diſcovered them very different from the former, as the right pupil did not eaſily contract and dilate; and that the left remained more dilated and immobile than in its natural ſtate, though I intercepted and expoſed them by turns to the light. However, I diſcovered by theſe very ſymptoms, that one eye was deprived of the faculty of ſeeing,

ſeeing, and the other declining in ſight. How and in what manner a phyſician ought to account for it, will be the ſubject of the following paragraph.

I aſked the gentleman many particulars concerning the beginning of the diſorder which preceded that under my preſent conſideration; to which he anſwered: A month before the defect of his ſight, he found himſelf ſo ill for ſome days, that he could not poſſibly tell to what accident he might attribute it, having lived very ſober; that a ſenſible dimneſs in his left eye, which he preſumed was the conſequence of the firſt complaint, came on ſuddenly. The diminution of ſight, he ſaid, did not at firſt give him great concern, as both the exterior appearance, and the pains he felt over the eyebrows and in his head, were trifling and tolerable. In eight days the diſorder made ſuch a rapid progreſs, that he thought it prudent to call for advice, being hardly able to diſtinguiſh the largeſt object with his left eye. The ſubſtance of what his phyſician told him conſiſted, that it was an approach of a return of the gout, to which he had been ſubject theſe ten years paſt; upon which prognoſtic, he preſcribed aperient medicines, together with bathing his legs in warm water, wherein a proportional quantity of muſtard was entered. But having taken a wrong way, it is very clear the ſucceſs could not crown his prognoſtication. Emetic then followed, but with a worſe effect; for the gentleman, who could ſtill diſtinguiſh the large bodies before the uſe of this vomitif, was totally deprived of that ſatisfaction. Afraid of loſing the ſight of the other eye, by the uſe of theſe remedies, he declared to his phyſician, that he had rather wait for blindneſs, than to be hurried into it in that manner; conſequently he remained for ſometime in this alternative, without any trial of medicaments whatſoever: Meanwhile, though he would not try any of

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these, he did not refuse to listen to advices; for which purpose he called upon every oculist whose names he was able to pick up, and satisfied himself with regard to the denomination of a complete gutta serena. By some, who understood the disorder in this light, he was advised bleeding at the jugulary two or three times, as the only remedy; by others, who were of a different opinion, he was proposed to make use of numberless eye-waters of their own composition, which, if they did not procure any relief, could do no harm. After so many advices, not very much to his liking, he again called his first physicians, who insisted upon bleeding at the jugulary, as the most prudent and advisable means in such a case. But the gentleman being terrified at such an uncommon operation upon him, declared he would not submit to it, as there was no positive assertion of any real benefit resulting from it. At last, tired of shifting, he was prevailed upon, though with a great deal of reluctance, to bear the application of leeches at his temples, and that of a blister on his shoulders, being means capable of supplying the effects of bleeding. These were then practised for several days; but seeing he reaped nothing by it, except intolerable pains and continual wakes, he said he was ready to abandon every medical operation when I saw him for the first time.

After these my observations, together with the detail above mentioned, I told him that I apprehended the physicians had not thoroughly considered his case, for, though I could not assure him of a perfect cure, yet I certainly should check the disorder, without putting him to any trouble or pains. Here is the case as I understood it. I could not doubt that it was a lymphatic obstruction in the vessels which ramificate the vitreous capsule, and only fixed on its posterior part, to such a degree

degree as to intercept the viſual rays, without being able to abſorb thoſe of a greater power; becauſe no other accident intercepting them, (what was conſpicuous by the contraction and dilatation in the pupils) indicated, beſides, no affection in the retina and optic nerve. I concluded, that, employing ſuch remedies as might undermine the cauſe, I had a right to expect ſucceſs; ſo that I preſcribed the continuation of the aperient medecines, and the bliſter behind the ears, removed there in the *interim* from upon his ſhoulders. The firſt was to prepare him for a ſtrong purgative, and the ſecond to take away the firſt as ſoon as poſſible. Four days after, he began to make uſe of the electrical fluid, No. XXXIII. three times a day, and the collyrium, No. XIV. one hour before every time: Four days after this, a ſtrong purgative, No. X. after which the bliſters were taken off; to which the diluent, No. I. was ſubſtituted, and the aperient medecines no longer made uſe of. He had not continued regularly this plan, than in a fortnight he had the ſatisfaction to ſee again the largeſt objects with his left eye, and with the right, as clearly as before the malady. The purgative, No. X. was preſcribed a ſecond time, and produced ſo great a benefit, with the continuation of the other, that every day he found himſelf better and better, both in health and ſight, till a complete cure was operated two months afterwards.

Every practitioner who will not ſhow himſelf imbued with the deſpicable principles of empirics, ought, in the hiſtory of a diſorder, to expoſe its cauſe, ſtate, what had been practiſed before he took it under his care, and, in ſhort, what method he uſed to remove it. To all theſe points, I think I have already ſatisfied; ſo that it remains now to lay down the phyſical reaſons by which the method operates, as well as the reſults, that one might expect from it.

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As soon as I had been confirmed in my opinion, that the diforder was an obftruction in the lymphatic arteries which ramificate the hyaloida to its pofterior part, as I have obferved above, I did not doubt a moment, that this obftruction owed its exiftence to a want of circulation in the lymph; and as this ftate occafions a dimnefs in the capfules of the eye, the means which could remove it were naturally recommendable. After fuch a prognoftic, grounded upon what I had remarked in the interior part of the globe, I prefcribed the diluent drinks to re-eftablifh the circulation in the lymphatic arteries; for the better effect of which I recommended, to fecond the firft, a frequent ufe of the electrical fluid whofe ftrength produced fuch violent fhakes on the globe of the eye, that all the mufcles contracting at the fame time, compelled the humors to fecrete a greater abundance of the lacrymal fluid out of the globe than ufual, and give the regenerative powers an opportunity of fupplying afrefh, as to operate a forced circulation. Would this method have been fufficient to cure the diforder entirely? Moft certainly not: becaufe the caufe not being deftroyed, the effect, though fufpended, might be fufceptible of a quick return. It was for the defect of this prefcription that I infifted, for a long while, on the continuation of the diluent drinks for internal remedies, though the diforder was quite removed.

If the obftruction had been fixed to fuch a degree as to admit of no remedy, the ufe of the electrical fluid would have produced an atrophy of the globe without any fuccefs, which is an indicative fymptom to leave it off. Its volatility may be diminifhed according to the occafion. All thefe points well weighed, and thoroughly confidered by an able and difcerning phyfician, fuch a diforder, though fufceptible of being wrongly underftood by many who make but indifferent obfervations, becomes

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a ſimple ſcience of practice. For my own part, I look upon bliſters applied either on the back, or behind the ears, as very abſurd remedies in theſe internal caſes, when there are ſo many gentler and ſafer ways to ſupply them. Let us ſuppoſe, for inſtance, that an obſtruction be fixed in the bottom of the globe, or ſocket, together with any other cauſes which produce thoſe kinds of momentaneous blindneſſes, ſo numerous as many practitioners think of meeting with a gutta ſerena, is it not very clear, that if a ſucceſs happens with the uſe of ſuch remedies, that ſuch and ſuch remedies have cured this diſorder, when it might be rather attributed, either to the effects of nature, or other means, for which an indifferent practitioner never knows to account? This is poſitively how moſt phyſicians have been led aſtray. When abſceſſes, puſtles, &c. exiſt in the bottom of the ſocket or globe of the eye, the patient experiences intolerable pains: the globe ſwells by degrees, till a ſuppuration takes place, with the irrecoverable loſs of the organ. In ſuch caſes, then, the patient's life being in danger, thoſe means are recommendable.

Obſervation. The more I advance towards the ſubject that treats of the affection in the retina, and the manner of diſtinguiſhing the ſymptoms which neceſſarily lead to the curative methods, the more delicate and conjectural it becomes; for which reaſon, I will keep within the bounds of ſome few obſervations upon this head, to render the matter leſs hazardous and more ſubſtantial. A young gentleman called for my advice in the following caſe: After a ſtrict examination of his eyes, I obſerved that one was not quite ſound, and the other, without being atrophied, ſunk in its orbit; that the humors and membranes were in their natural ſtate, and the pupils hardly ſuſceptible of contraction and dilatation, but not immobile, as to make me conceive, after

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a ſlight inſpection, that the other organ was totally deprived of ſight, which was, however, the real caſe.

Every practitioner will allow, that the preſent caſe was very eaſy to be miſtaken for an affection in the retina, or optic nerve, when the patient will not acknowledge his defect of ſight. But before I enter into the detail, I think it will be neceſſary to ſtate an abſtract of it. The patient caught a cold; ſome days after, a dimneſs was the conſequence: the diſorder not being checked, increaſed by ending with the loſs of the organ; bliſters applied behind the ears, with many other applications without advantage; then bleeding, and the uſe of mineral waters: theſe promoted a dimneſs in the other organ, inſtead of procuring relief. This is what preceded my interview with the gentleman. I will now lay down the pathognomonic ſigns of the diſeaſe as I underſtood it.

The perſpiration being intercepted, as the conſequence of the cold, at a time when both the blood and lymph were in an acrimonious ſtate, (as I apprehended it by the patient's account) an inflammation took place, which diſſolved part of the beds of fat in the bottom of the ſocket, either by the uſe of the medicaments above deſcribed, or the diſpoſition of the diſeaſe; ſo that the optic nerve which runs through them, being affected for want of its natural ſupport, became leſe ſenſible to the communication of the impreſſions of the retina, produced by the rays of light, than to the ſharpneſs of humors and its bad ſtate; conſequently, it is eaſily conceived, that, being deprived of this ſupport and eaſe, the pupil did not, nor could not, dilate and contract as when the eye is in its equilibrium. A practitioner muſt have had frequent opportunities of obſerving, that the pupil, inſtead of contracting and dilating regularly, has no regular motion of contraction and dilatation, when the

the iris floats in the aqueous humor, for want of a communicative ſtrength, able to put its fibres in regular activity; becauſe, if he pays a proper attention, and remembers, as I ſaid above, that the impreſſion of the viſual rays are communicated from the retina to the optic nerve, and from thence to the brain, to complete the ſenſation, he muſt certainly be conſcious, that during this operation of ſenſation, the retina communicates its motion or vibration to the proceſſus ciliaris, which is afterwards propagated to the iris: for which reaſon, if, in ſuch a caſe, the retina is not yet affected by the ſame diſorder as the optic nerve, the impreſſions and motions, though in part interrupted, do not hinder thoſe produced on the immediate organ of ſight, to ſet the fibres of the iris in ſlow and irregular motions: therefore, this proves to be but a floating of the iris, inſtead of a regular contraction and dilatation in the pupil. Theſe ſymptoms, I think, are ſufficient to make any practitioner diſtinguiſh an affection in the optic nerve and retina from any other diſorders of the eye; conſequently, in the above diſorder, to re-eſtabliſh the organ in its firſt ſtate, it would have been ſufficient, not only to recommend the uſe of ſuch internal and external medecines as would have corrected ſharp humors, and ſuch as bring the body to a due temperament, but yet to countermine ſuch other effects which are continually ariſing either from ſuch remedies, or habit of the patient.

The diſſolution of the fat, which lines the bottom of the orbit, was a ſymptom ſufficiently indicated by the ſinking of the globe in its ſocket, and the want of regular contraction and dilatation in the pupil, the only viſible ſymptom of that defect; to which, if proper remedies had been applied, no other inconvenience would have been the conſequence. By reaſons unneceſſary to mention, I did not take that diſorder under my care.

Remarks. The moſt ſcrupulous obſerver muſt daily remark, that, of all the ſymptoms which fortel an affection in the optic nerve, there are none ſurer than the ſtate of the pupil; and that thoſe which announce an affection in the retina, without that in the optic nerve, there are none ſurer than the immobility of the pupil, though day from darkneſs may be diſtinguiſhed. Becauſe, in the firſt place, as ſoon as one is certain that nothing intercepts the rays, and that they are abſorbed on the immediate organ of ſight, the fibres of the iris receiving their motion from the retina, the contraction and dilatation in the pupil, is a certain indication of its being ſound; on the contrary, and in the ſecond place, thoſe fibres not receiving their motion, is a clear ſymptom, that the retina is totally affected, though the optic nerve might be ſound. But before diſmiſſing this important ſubject, I ſhall obſerve here, that there are ſeveral circumſtances wherein it is impoſſible to ſee the bottom of the globe, and conſequently diſcern one from the other: For example, if the pupil be contracted in ſuch a manner as to be almoſt occluſe, and immobile in this ſtate; if the cornea be opacified, or the cryſtalloida and cryſtalline, &c. &c. how can it be poſſible to look into the bottom of the globe? Now, let us ſuppoſe that all theſe caſes be out of the way, there are ſtill a great many others, whoſe prognoſtication is impoſſible. For example, If the nigrum pigmentum be of a grey color, one cannot preciſely foretel whether blindneſs be occaſioned for want of this ink, or by an affection in the retina and optic nerve. There are alſo many other caſes, though better known, wherein one is obliged to conjecture, either by the help of an intelligent patient or his own experience; but when a practitioner performs what ſound phyſic, and good reaſoning enable him, he can neither be blamed nor reſponſible

when

when his human faculties fall ſhort to gueſs all the different changes, which Nature is ſuſceptible of aſſuming. It is for man alone to lament, that the All-wiſe Creator did not think fit to proportion his faculties with his wants, and to bear in patience and humility the ſeveral afflictions that God pleaſes to ſend him.

Obſervation. A country woman, aged about thirty years, and of a very ſanguine conſtitution, went to a pond for waſhing, at the time her menſes were flowing. As the day was mild and warm, ſhe did not take any precautions for her ſituation, and walked into the water till it reached her knees. She had not been in a quarter of an hour, till ſhe immediately began to feel the conſequences of it, by a ſudden ſuppreſſion: Palpitation of the heart, ſuffocation, intolerable head-achs, and ſome momentaneous convulſions were the reſults of her imprudence. Two days after the accident, ſhe complained of a total defect in her ſight, though her eyes appeared in their natural ſtate. The phyſician who was ſent for, recommended a copious bleeding at the foot, thinking that the diſorder, which he called gutta ſerena, was the conſequence of a ſanguine obſtruction fixed round the optic nerves, and in the internal parts of the orbits. This produced very little effect; but having repeated it twice, the menſes began to flow by degrees, till they were perfectly re-eſtabliſhed; and within ſix days, the accidents diminiſhed ſo much to the advantage and comfort of the patient, that ſhe began to diſtinguiſh the objects. The diſorder having been well prognoſticated and regularly attended to, the cure was completed a week afterwards.

This obſervation, and a great many others of the ſame kind, has been publiſhed in all the periodical books and pamphlets that France produces, as an aſſertion, that no other method but bleeding could be the curative indica-

tions for a gutta ſerena. It was given out at the time of this diſcuſſion, whether bleeding was not more detrimental to the ſight of man than uſeful; and as the diſpute was ſupported and carried on by ſeveral phyſicians of abilities, this rendered it the more intereſting, though the queſtion remained, as it is ſtill at this preſent time unſettled. Now, if one conſiders the management of the phyſician, in the above caſe, he cannot refuſe him thoſe praiſes ſuch a ſucceſs deſerved; but when he comes to weigh the opinion he gives out in this very obſervation, for the curation of a gutta ſerena, (grounded upon this and ſuch other caſes) *that nothing but repeated bleedings are directly pointed at*, I am pretty confident he ſhall think quite otherwiſe. It is from this bad method of explaining and laying down the hiſtory of diſorders that numberleſs methods, for the cure of the gutta ſerena, have taken place. If the obſerver did relate plainly, that ſuch a blindneſs, produced by ſuch or ſuch a cauſe, has been cured by ſuch or ſuch means, practitioners would clearly underſtand, that bleeding, adviſed by ſome, is abſolutely neceſſary in ſuch or ſuch caſe, and contrary in ſuch or ſuch other. When ſome phyſicians have obſerved, that ſeveral people, blind of the gutta ſerena, have recovered their ſight by frequent bleeding, and concluded there was no other means, they have done as bad a piece of ſervice to human kind as they thought it excellent: Therefore, obſervation and a proper method to do it, is now the only way to clear up this matter, or at leaſt to render it leſs obſcure. In fact, to relate that ſuch or ſuch a blindneſs, occaſioned by ſuch or ſuch a cauſe, has been cured by ſuch or ſuch means, is proving clearly, that one has a mind to be really uſeful in ſociety.

"The obſervation mentioned in one of the pamph-
" lets (quoted page 141.) may be conſidered on this
" line;

" line; that is to ſay, that a gutta ſerena reported ha-
" ving been cured by the uſe of poſitive electricity, is
" apt to miſlead a practitioner; for ſuch a diſorder may
" be looked upon as phyſically incurable: If it be inci-
" pient, the term gutta ſerena is miſapplied."

Obſervation. Blindneſs is not always exiſting through the ſame cauſes, though no ſenſible difference over the exterior parts of the globe appears to common people. Nature preſents ſo many variations of this kind, that it is extremely rare when a practitioner, even in the moſt extenſive practice, has met with all thoſe caſes. A young man about twenty, called for my advice in the following diſorder, which every phyſician he had conſulted before had deemed an incurable one. Having looked into his eyes with the moſt ſcrupulous attention, I obſerved that the globes were ſound and regular exteriorly, that is to ſay, parallel both in their axis and ſize, though he was obliged to turn the head on the left ſide to ſee with his right eye. I at firſt took the diſorder for a ſtrabiſm; but, upon further conſideration, I was obliged to change my opinion. The diſcovery of the apparent cauſes of this phœnomena ſeemed to me ſo curious and extraordinary, that I endeavoured to explore them, by every trial and experiment the occaſion permitted; for which purpoſe, I placed the young man juſt oppoſite the window, in order to diſcern clearly, not only the ſymptoms from the cauſes, but the ſigns that might ground both. Having deſired him to put one hand over the left eye, to keep it continually ſhut, I raiſed up ſoftly, and with precaution, the ſuperior eye-lid of the right eye with the fore-finger of my left hand, and brought down the inferior eye-lid with my thumb; then I oppoſed my right hand near his eye, to intercept and expoſe it alternatively to the light, to know if the pupil was ſuſceptible of contraction and dilatation: but when

when I had obſerved ſome difficulty, I immediately conjectured it came from a want of ſome meconium on the choroides; having remarked, beſides, that the bottom of the globe was blacker on the ſide of the great angle than on that of the external's. This laſt remark grounded my conjectures, that the choroides was covered of meconium in its internal lateral part, whereon the rays of light came to ſtrike on this part of the retina, and be only abſorbed there. I proceeded afterwards to the examination of the left eye, wherein I obſerved, that the choroides was entirely deprived of meconium. This was very diſcernable by the whitiſh color in the bottom of the globe, immobility in the pupil, and blindneſs of the organ. But before proceeding, an objection naturally ariſes here, Could not the retina be paraliſed in one half of its extent? To this I anſwer, that ſince a motion of regular contraction and dilatation in the pupil, aſcertained by the ſtate of the immediate organ of ſight, (as being ſenſible to the impreſſions of the rays of light when abſorbed upon it) it was a ſufficient proof in favour of the negative. If this contraction and dilatation had only exiſted on one and the ſame ſide of the iris, ſuppoſed in paraliſy, the objection might have ſome weight. I ſhall ſay, moreover, that this diſorder derived its beginning from the young man's birth, and had augmented ſucceſſively to the degrees I have juſt now mentioned.

I made many other curious remarks upon the ſight of this young man; but as I am afraid of becoming too prolix, I ſhall finiſh this obſervation by what follows. I preſented to him a crown piece placed horizontally at three and four feet diſtance from his eyes, which he declared only viſible by his right eye, in turning his head from the right to the left, the axis being continually parallel. This done, I removed the crown to another place,

place, where any other perſon might have been able to perceive it without motion either of the head or eye; but he ſaid it was not in his power, without a motion of his head. In ſhort, the ſeveral experiments I made furniſhed me with freſh proofs, that a want of nigrum pigmentum on the choroides, and not a paraliſy in the retina, was the cauſe of his organ being deprived of the faculty of ſeeing the objects to all ſorts of poſitions, without turning the head.

When I had ſtrictly examined the above caſe, and weighed all the circumſtances, it appeared clear enough to me, that this diſeaſe owed its exiſtence to the want of nigrum pigmentum in the choroides, to operate the abſorption of the rays of light upon the whole immediate organ of ſight. The reality of this prognoſtication was obvious in the pupil's motion. When I pry into the remoteſt cauſes, I find that this diſorder could not be occaſioned but by a relaxation in the blood and lymphatic arteries which ramificate the choroides; and that for want of a ſufficient tone in them, this black humour could not ſtay upon the ſurface of this membrane; becauſe, as I have ſufficiently proved elſewhere, the ſight muſt be diminiſhed in proportion to the want of this ink, as it is abſolutely neceſſary to perform the abſorption. I may now ſafely conclude, that the different methods of curing the gutta ſerena have been diſcuſſed with ſome foundation, and, to expreſs myſelf at large, have never been as duly attended to as they deſerved to be completely ſettled.

Observation. The following caſes do not a little contribute to confirm what has been advanced in the above. A woman, aged 40 years or upwards, begged that I would look at her eyes, merely to ſatisfy her curioſity, as ſhe was well aſſured, ſhe ſaid, by phyſicians

of

of great abilities, that nothing could relieve her. I observed that the exterior of one globe was perfectly ſound, together with the parts which ſurround it; that the pupil, however, was immobile, and the bottom of the globe of a whitiſh colour, the choroides being entirely free from meconium. The other eye was ſound, both exteriorly and interiorly. Now, to acquit myſelf in the beſt manner poſſible on ſo important and curious a ſubject, and, at the ſame time, leave nothing to wiſh for an inquiſitive reader, I will begin by explaining the effects of this diſorder, together with its cauſes, and the method employed to cure it, according to the woman's own account.

The beginning, ſhe ſaid, was the reſult of a laborious and unlucky lying-in, attended in a careleſs manner. She was recommended by a perſon of note to an eminent phyſician, who preſcribed the uſe of diluent drinks, together with ſome light purges for internal remedies, and the reſpiration of ſpirituous liquors, with aſtringent lotions for external ones. She recovered the ſight of one eye, whoſe uſe ſhe had entirely loſt, and the other, whoſe ſtate had been very much impaired, was quite re-eſtabliſhed in its former ſtate. A little time after, ſhe again loſt the ſight of this organ, and the other kept well; for which purpoſe, ſhe called for aſſiſtance to the ſame. She did not meet with the ſame cure as at the firſt time; for ſhe remained blind of this eye.

When I conſider that viſion cannot be effected without nigrum pigmentum on the choroides, I juſtly conclude, that if its abſence comes from an obſtruction in the blood and lymphatic arteries (as this caſe was certainly ſuch) which bring and ſupply this black humor; it cannot be occaſioned but by a cryſpation in the tubes, and a defect of their contents. Beſides, when I reflect, that the courſe of this humor, if intercepted before it arrives

rives on the choroides, continues its exſudation through the excretory pores and humors of the eye: I conclude alſo, that theſe membranes muſt inevitably be deprived of this ink, and that the rays of light, being no longer abſorbed on the retina, the faculty of ſeeing muſt ceaſe. I am very far from being ſurpriſed, that the reſpiration of a ſtrong fluid has produced the recovery of the ſight; that it may have failed, anſwering the ſame purpoſe, to all appearance, in the ſame caſe; becauſe, every phyſician muſt allow, that a ſagacity to diſtinguiſh, if it will do at one time and not at another, is ſuch a profound ſkill, as it is not in every one to boaſt being poſſeſſed of. Upon this foundation, I think that the remedies being well indicated at firſt, they operated the deſired effect; and if they did not the ſecond time, the cauſe may be attributed to a change of the diſorder, though in appearance the ſame: for as I have hinted above, the malady being occaſioned by an obſtruction, the uſe of the electrical fluid properly preſcribed, removed it at firſt: but, on a ſecond repetition, the effect was very likely too violent, as it operated an exſudation more copious than the regenerative powers of the nigrum pigmentum could ſupply; conſequently, the choroides diſcontinuing to be tinctured with this ink, and the rays of light not abſorbed on the retina, it is eaſily apprehended, that the faculty of ſeeing muſt of courſe ceaſe. This is a clear demonſtration, that the uſe and application of ſuch remedies require the greateſt care, intelligence, and ſkill; for otherwiſe it would be very rare, if they might be of any ſervice in ſuch doubtful caſes.

The ſymptoms of this diſorder, which I have already denominated meconiumleſs, (the words meconium and nigrum pigmentum are ſynonimous) are pains in the internal parts of the orbit, a whitiſh color in the bottom of the globe, and a diminution of ſight, proportioned

to the want of this ink on the choroides: Moreover, an atrophy of the globe, and a conſtant exſudation of the lacrymal fluid through the pores of the cornea, are the forerunners of this dreadful complaint, which, when arrived to a great degree, may be looked upon as incurable.

Theſe few principles are ſufficient, I hope, to convey an idea of the proper remedies fit for checking this diſorder, and the manner of adminiſtering the electrical fluid, No. XXXIII. without running any chance of making a bad uſe of it, and to diſcern one caſe from another. Beſides, if one pays a due attention to the caſe, and the difficulty there is to give ſome ſpring or elaſticity with this electrical fluid, when wanted to all the languiſhing fibres which compoſe the internal and thin membranes of the globe, without producing a too great circulation in a meconiumleſs diſorder; he muſt be ſenſible, that it is difficult to deſcribe the uſe and effects of this electrical medicine, and that it can be accounted for but by giving the detail of ſome obſervations grounded on phyſical laws. Amidſt all theſe difficulties, there is another to explain, which is of no ſmall weight; it is the properties of this remedy. This electrical fluid, or ſpirituous liquor, uſed either by evaporation over the globes, or reſpiration through the noſe, produces a coagulation in the humors, and an elaſticity to the exterior membranes; becauſe the oily parts, which compoſe this remedy, are brought up along with the volatile ones into the interior of the eye, by joining together: So that, if one intends to diſobliterate the gelatinous humors, it will upon firſt conſideration appear contradictory conſidering this quality inherent in it: but when he comes to the experiment, inſtead of coagulating, he perceives the obſtructions give way by degrees; becauſe, as I ſaid above, the ſhock it gives to all the parts of the organ, produces

ſuch an action in the ſix muſcles, that the humors it contains are obliged to go out through the lacrymal ways, to be then ſupplied by the regenerative powers of the humors. This operation produces ſuch a quick change, that deſobliteration takes the better of coagulation in a ſurpriſing manner, and without any danger to the organ when duly attended to.

But to return: I have obſerved this diſorder very frequent in children; and I think, that if the meconium be not ſo black in children till they are arrived at two years old, it is to preſerve the ſhock of the rays of light on ſo delicate a part, in ſo tender an age. Curioſity led me very often to a gentleman's who had a child afflicted with this complaint. The firſt time I looked at her eyes, I was ſo much ſurpriſed to ſee her globes in continual rotation, when ſhe turned them towards the light, that I felt a great inclination to find out the cauſe. To be brief, I imagined that the bottom of the globes were not regularly lined with meconium, otherwiſe the globe would not have been continually in motion to endeavour to fix and abſorb the rays of light on the retina. This action of rotation could be occaſioned but by an endeavour of re-uniting the rays on the part of the retina whereon the abſorption might be the moſt complete: Moreover, the contraction and dilatation in the pupils, which I remarked at different times, when the rays did more or leſs ſenſation on the immediate organ of ſight, was a ſufficient proof to ground my conjecture. I did not propoſe any trial of remedies, being myſelf conſcious of their defect; and ſupported their hopes in the operation of nature, a credulity too often encouraged, when natural phyſic is againſt it. I have been conſulted in a ſimilar caſe for a child of two years old.— When he was expoſed to the light, his eyes rolled with the quickeſt motions; when ſtanding upon his legs, tho'

 ſomewhat

ſomewhat ſupported under the arms, frightful convulſions during the whole time, and a ſudden inflammation in the eyes, were the never failing conſequence. As ſoon as he was ſeated, the convulſions and inflammation diſappeared, by degrees, in the ſpace of ten minutes.—The reader may well imagine, that I did not propoſe any remedy, as ſuch ſymptoms ſpoke clearly a complication of meconiumleſs, with an affection in the nerves.

Poſitive electricity, according to Mr MAUDUYT's account, produces generally the departure of the diſeaſe from one part to another, with very little change or effect; for which reaſon he candidly ſays, that having been appointed by government to make the experiments, and ſtate the facts without accounting for them, he leaves this delicate point to be ſettled by the ſeveral phyſicians who ſent him the patients, as being better able to judge of their different maladies. For my part, as I am concerned in it, I have ſome right to tranſmit my opinion, that the uſe of poſitive electricity is very immaterial in the medical diſorders incident to the human eye. As to the negative electricity, which ſome have ſuppoſed to produce different effects, we are now convinced of being perfectly the ſame as poſitive; therefore, we do not think proper to recommend it.

CURA-

CURATIVE METHODS

FOR THE

COMPLICATED DISORDERS

OF THE

EYE AND ITS APPENDAGES.

IT is not ſufficient to have inveſtigated each kind of blindneſs in particular, and the diſorders which are conducive to it; it is beſides neceſſary that I ſhould ſpeak of ſuch as depend upon one another, and their complications. Every body knows, that there is no other organ in the human frame which is ſubject to ſo many diſeaſes as the eye. Some phyſicians and ſurgeons have thought, that the knowledge to diſcern the character of theſe various affections, and a proper method to remove them, was, or ought to be a particular art, which did not require the phyſical and chirurgical ſcience in general. Of what benefit would this branch be ſuſceptible if ſeparated from its ſtump? The improvements in all ages has ſprung from the greateſt maſters who practiſed it in all its plenitude, and whoſe experience,

experience, relative to the diſorders of the eyes, has been enlightened by the principles that conſtitute indiviſibly the ſcience, without which it is impoſſible to exerciſe any part with judgment. The antients have learnedly ſpoken of ſome parts which compoſe the eye; it even appears that they practiſed ſome delicate operations to cure them when diſordered; but as the abuſe of ſome principles of practice, recommended by phyſicians of reputed abilities, have great influence over the opinion of the medical world in general, as being too often improperly underſtood according to ſuch a plan, I think it of great utility to inveſtigate. I have read Dr William Cullen's works, whoſe principles are generally adopted; Dr Brown has ſeverely criticiſed the whole, or at leaſt moſt part of them. We know what motives induced him to take ſuch a ſtep, and that words are inſufficient to overthrow a ſtupendous building, wherein the critic himſelf had a great ſhare in the erection; but as my work does not admit to interpoſe in the contention, I will confine my criticiſm only about Dr William Cullen's principles on the ophthalmia, which are highly improper, and by no means grounded on the anatomy and phyſiology of the organ of ſight. I could mention ſeveral caſes like the following, to prove the impropriety of the method; but after what I have ſaid concerning inflammations, I deem it unneceſſary.

Donald M'Donald, aged 38 years, now a ſervant to Sir William Dick, at Prieſtfield, near Duddingſton, applied to me about the latter end of Auguſt 1787.—He was then labouring under an ophthalmia, attended with violent pains in the head, temples, and wakes. The diſorder began the 15th of June preceding, accompanied with rhumatic pains in his right thigh and leg. Sir William recommended him to Dr William Cullen, who preſcribed laxatives and the peruvian bark; this plan was purſued

pursued for some time, but proved of no service. Mr James Russel, surgeon, jointly with the Doctor, advised blisters, leeches, collyriums, *&c.* and yet the disease increased with their plan; when, at last, they thought proper to say, that its cause was debility, and diffused through the whole system. The first day that the patient called for my assistance, the eye was fumigated with emollients five times a day, and took at bed time 35 drops of laudanum in two ounces of water, and continued increasing the dose of one drop more every night, till the 7th day, when all pains subsided. The 8th day a dose of the pommatum detersivum, No. XXXII. was applied at the edge of the superior tarsi of the eye-lid, and continued five times once every other day; so that in the course of 16 days, he was perfectly free from all complaints.

Remarks. The case was simply this: The varicous vessels of the conjunctiva had increased to a prodigious degree; some of them were ramifying over the cornea, which was very dim. The detersion of these blood vessels being effected, a cure was obtained without any of the means recommended by Dr Cullen and the surgeon; and if the patient had been Dr Brown's, I have not the least doubt, that whisky would have been as ineffectual. There are many surgeons who scarify the conjunctiva and cornea in such cases, which, in my opinion, is the worst of all practice, although the principle seems to be the same. This needs no refutation, by what I said elsewhere.

I am confident, that had the patient persisted on the above plan, the disorder would have degenerated into an hypopion, and perhaps the loss of the organ. Whenever there is loss of substance in the cornea, it is but seldom if a practitioner does not find it safer to empty the globe,

globe, than to attempt to palliate the case. Having said thus much on these cases which lead to a destruction of the globe, I shall now indicate the properest rules for the extirpation of the eye, it being an operation of great moment, as the patient's life is commonly in danger.

The falling of the globe, or its entire going out of the orbit, presents the very case wherein amputation is so well indicated, that it needs no further advice. Several observations prove sufficiently that the eye may be pushed by degrees on the cheek, on account of some tumor which may arise in the bottom of its socket. To avoid here a confusion between the falling of the eye, its prominence, excess of bulk, and going out of the orbit, by the same denomination of *exophthalmy*, this term shall be employed to signify only its going out of the orbit by extrusion.

The beds of fat which surround the posterior part of the globe, are naturally flabby; and this is very well designed by nature, to help the motions of the muscles. A great many practitioners have observed, that this texture is adipous, and becomes fonguous, or schirrhous in swelling. In this case, the eye appears weeping at first: as soon as it is pushed outwards, the eye-lids cannot cover it; then it becomes inflamed.

If the tumor makes a rapid progress, the pains are violent and intolerable. When the disorder does not yield to the general remedies, such as bleeding and purgatives, the extirpation is very often indicated, to rescue the patient from death. This is very obvious by the following observation. A woman had the globe of her eye jutting out by a gathering of humors, which inflamed the beds of fat. Besides, this disorder was attended with violent pains and wakes. The physician who had the care of it, asswaged these accidents by proper remedies for such a case; so that the progress of the tumor

was

was checked for a while. About three years after this treatment, the globe of the eye became lead-colored, and extremely puſhed outwards, on account of a protuberant deformity which had been left behind: Its membranes were tumified, and aſſumed a gangrenous quality. Some time after, the patient experienced a violent fever, with intolerable head-achs. The phyſician and ſurgeon who attended her, unanimouſly thought proper to proceed to the extirpation of the globe; and the neceſſity of this operation ſeemed ſo preſſing, that it was performed the very next day: four or five days after the fever and all the other accidents ſubſided, and the cure quite completed the 20th day following.

The principle of the diſeaſe is ſometimes to be found in the outward parts of the orbit, near the bony laminæ which form the inſide of this cavity: they are ſo thin, eſpecially at the inferior and ſuperior parts, that one ought not to be ſurpriſed when they give way to the efforts of a fongous tumor, by the compreſſion of which they are ſoon deſtroyed, nay worn out. A man aged forty years, to whom a carcinomatous fungous in the maxillary ſinus had deſtroyed the bony laminæ of the top of the orbit, was ſo much afflicted by it, that the globe of the eye was almoſt on the cheek: his face looked ſo hideous and disfigured, that it was frightful: There was at that very time carie in the maxillary bone, on the ſide of the palati and naſal cavities; in ſhort, the patient died by the accident of a cancerous ulceration in theſe parts. The exophthalmy was an effect of the exceſſive bulk of the tumor, to which the bones had not been able to oppoſe a ſufficient reſiſtance, and limit its progreſs. There is no doubt, that one would have prevented ſuch dreadful conſequences, in attacking the diſorder on the ſide of the mouth. The carcinomatous vegetation was an accident of the diſorder in the bone,

occaſioned by a venereal principle, which had been treated without method.

A child three years old, having his left eye entirely out of its cavity, and twice as large as a fiſt, died of this diſorder, which only began to appear ſome months before. As ſoon as the ſkull was opened, a fungous tumor was diſcovered, whoſe baſis was attached to the dura-mater above the orbit, without having produced any alteration in the brains. The protuberancy of the eye was only the accident of it; and the amputation, though very rightly indicated at firſt, would very likely have had no ſucceſs. The cure conſiſted in deſtroying the fungous vegetations in the dura-mater. Since the brains were found after the extirpation of the eye, ſurgery would moſt likely have found ſome means to conſume the tumor to its very root: the patient being given up to a certain death, it was ſufficient to attempt the operation, in hopes of ſucceſs.

It is not an uncommon caſe to ſee the eye driven out of the orbit by the compreſſion of an exoſtoſis: if it be exterior, one may attack it with advantage, without making a ſacrifice of this organ. A woman aged thirty years, afflicted with a fiſtula lacrymalis, had undergone, without benefit, an operation which was thought proper for this fiſtula. The bones ſwelled prodigiouſly: Fifteen years afterwards, the exoſtoſis of the os planum and internal angular apophyſis of the coronal, acquired the bulk of an egg. The globe comprimated laterally, had been puſhed out of the orbit, and fell in ſome ſort over the cheek, on the ſide of the external angle. This exoſtoſis was attacked with a cauſtic: it ſuppurated, and in a treatment of three or four months, the exfoliation of a conſiderable portion of the tumified bones was effected. The eye was re-eſtabliſhed in its natural place, and perfectly cured ſome time after.

Practitioners

Practitioners have very often confounded the falling of the eye and its protuberancy, with the dilatation of the globe, which make it equally jut out of the orbit. These disorders, so different in their nature, have been pointed out by several authors under the same denomination. This confusion, as I said before, has not a little contributed to produce some ambiguity on the precepts, and consequently to make the theory doubtful, and practice uncertain. The term *hydrophthalmy* shall be used to express particularly the excessive bigness of the globe, by an augmentation against nature of the humors. This denomination, which in this case does not allow of any equivocation, as it would with the term exophthalmy, has been agreed upon by all regular physicians and surgeons. It is not always the whole globe which is pushed outwards; its bulk is yet augmented by an excess of fulness. The elevation of the cornea and deepness of the iris, are the characteristic signs of it: on the contrary, when the largeness of the eye comes from the excess of the bulk, acquired in the vitreous body, the iris is convex, and forwarded into the anterior chamber: with all these symptoms, the hardness of the globe is sensible to the touch, unless this humor be fallen in a dissolution.

An intelligent practitioner will distinguish, by an extreme dilatation in the pupil, whether the vitreous body contributes to the prominency of the eye or not. The augmentation of the aqueous humor is sufficiently marked by the elevation of the cornea, and deepness of the iris. The patient, in such a case, feels continually in the bottom of the eye and head, violent pains, attended with fevers and wakes. This disorder is commonly chronic: it may, however, subsist in its state without change, when the eye is arrived to the last degree of extension.

The authors propoſe a great many remedies for this diſorder, both general and particular, internal and topical, and varied according to the different indications. I will here give ſome few obſervations upon this head. Two young ladies were afflicted with the ſmall-pox at the ſame time; one was twenty years of age, and the other four-and-twenty; the variolous matter fixed itſelf in a great abundance on the eyes; the puſtles were dried over the whole body; and there would have been no doubt of an happy termination of the diſorder, had not the eyes been very much affected with it. Their tumefaction occaſioned a fever, and violent pains, attended with exceſſive heat and pulſation; ſo that the cutting open of the eyes were adviſed to ſave their lives. This advice was not followed, though it was given out that the organs were without any reſource. The ſudden death of one of theſe young ladies gave great concern, for not having taken the above advice. As to the other young lady, Nature herſelf ſaved her from this dreadful caſe; for a ſpontaneous aperture was effected, through which the gathered matter ran out of the globe; but ſhe remained blind, after having ſtood a great chance of loſing her life.

This remark will have its uſe in all the caſes wherein the ſurgeon ſhall be obliged to empty the globe, (if the organ be irrecoverably loſt) to calm the violent accidents which are the conſequence of an inflammation in this organ, in caſe of wounds, conſiderable contuſions, and abſceſſes in the interior of the eye. It is ſufficiently proved, by a great many obſervations, that the pains, fevers, wakes, deliriums, and convulſions, which ſometimes accompany this ſtate, do not ſtop but when a rupture in the tunics of the eye has taken place, either naturally or artificially. When there are no hopes of preſerving the functions of this organ, the patients will be

be refcued from many accidents, if an incifion be performed. Some practitioners have alfo advifed the extirpation of the globe for a fingle fungous excreffence, which arifes on its furface, though there are a great many that one might deftroy without an operation. It is then very material to lend the greateft attention for difcerning the character, from the extent of the diforder; the indications are lefs diftinguifhed from the bulk of the tumor, than from its nature and roots. It is by the help of commemorative inftruction, on the rife and progrefs of this diforder, that one may be well acquainted with this laft circumftance; the pathologic knowledge will fhew the particular kind and fpecies of tumors. Thefe principles, deeply reflected upon, ought to be the bafis of the judgment through which a practitioner fhall determine, whether he muft, and how he is to operate: It is but after fome facts of practice, that he may fettle and fix a folid doctrine upon the feveral different cafes.

It is demonftrated that the fungofities in the eye, fuppurate very well after the application of diffecative remedies. Thefe tumors having not their roots very deep, one ought to be contented, in this cafe, to feparate the fungofity from the parts with which it is tied, and to confume or take away but one part of the globe. As to the treatment of the cancerous tumors in the eye, one ought alfo to difcern the ftate from the cafe, to determine which method is the propereft; for every one muft know, that thofe which are not completely extirpated with all their roots and appendages, regenerate foon of themfelves, and very often with more dreadful confequences or fymptoms than at firft. Therefore, if the operator fufpects the propagations of the cancer in the eye, capable or fufceptible to extend deeply, he muft not hefitate to extirpate the globe entirely. We meet

with

with numberleſs facts which do not leave one ſingle doubt on the neceſſity and uſe of this operation; but the rules which he ought to follow for practiſing it methodically, having not been eſtabliſhed in their whole extent by the ancient authors, ſhall be taken notice of here. The infallible loſs of ſome patients, for whom this reſource has not been made uſe of, the happy cures which are owed to it, ought to encourage modern ſurgeons to perfectionate this operation, and render it as ſimple, and eaſy as it is uſeful.

The operator ſhall begin by inciſing the ſtrings of the globe, together with thoſe of the eye-lids, without it be neceſſary to have a particular inſtrument for this preliminary ſection; but it may be performed with more or leſs method: inferiorly, it ſuffices to cut in the angle or fold which forms the conjunctiva and the internal membrane of the eye-lid; he ought not to forget at the ſame time the fixed ſtring or tie of the *muſculus obliquus inferior*, to the inferior edge of the orbit on the ſide of the great angle: Superiorly he ſhall direct the point of the inſtrument to cut the *muſculus attollens* of the ſuperior eye-lid, together with the membrane which lines this eye-lid; and in ſliding a little the knife from top to bottom, on the ſide of the internal angle, he ſhall cut the tendon of the *muſculus obliquus ſuperior*. This performed, the eye is no longer faſtened to the anterior circumference of the orbit: Then it remains to cut the optic nerve, and the muſcles which ſurround the bottom of this cavity. This may be done very eaſily at one cut with a pair of curved ſciſſars on their plane, adapted for this ſection. The ſide on which he ought to direct the extremity of the ſciſſars in the bottom of the orbitary cavity, ſeems at firſt very immaterial. In the natural ſtate, the obliquity of the plane of the orbit, and the ſituation of the globe near the internal inſide, ſeem to

preſcribe

prescribe the introduction of the scissars, by way of preference, on the side of the external angle, in directing the cavity of the blades on the external lateral part of the globe: but as the protuberancy of the eye, its dilatation against nature, the tumefaction of the fat, and the schirrhous obstruction in the cellulary texture, are confined in no bounds whatever; and that the fungous vegetations take their rise on the side, where is naturally the least resistance; the side of the external angle is that which he will find the most entangled. It is therefore at his disposal to enter in the orbit with these curve scissars, on the side which will be most convenient to him. The muscles and optic nerve being cut, the scissars shut, serve as a sort of spoon to raise up the eye outwards. To finish this simple operation, he shall take hold of the eye, with the left hand, and if the cellulary texture be still tied to the neighbouring parts, he shall cut it off along with the laminæ.

Such is the operation thought proper for extirpating methodically the globe of the eye, in case the disorder is limited to the parts which constitute this organ. The treatment which is to be pursued afterwards, ought to be conducted according to the patient's constitution and health. Bleedings, regular and strict diet, are of absolute necessity, to check the inflammation: the dressings consist in an animated digestive No. xxxv, and a mixture of warm wine and brandy after it.

The necessity of extirpating the eye-lids with the globe, shall be determined by the exterior progress of the tumor, whether it be carcinomatous or not. The greatest difficulties to be met with, are not those which come from the extent of the disorder at the exterior: they are, as to this respect, before the eyes, and under the hands of the operator: the main point is, to consider what progress it has made in the orbit. It does not suffice

fice to have extirpated the eye; the fat which ſurrounds the globe inwards, are very often ſwelled; if he was to leave them behind, they would prove the ſprouting of a new tumor: nay, the glandula lacrymalis, provided it be tumified, ought alſo to be extirpated. The operator ſhall cut it off eaſily from its particular cavity, with the point of the ſame curved ſciſſars with which he ſhall have extirpated the globe. They are very convenient to take off the ſchirrhous hardneſſes, which might exiſt in the extent of the orbit; in ſhort, for the extirpation of all cancerous tumors.—Of whatever efficiency an operation may be, a prudent practitioner will always attempt the cure of any diſorder by ſome medicaments, before the undertaking of it.—Every method in the art of healing, is equally in the power of an able medical man.

PHYSICO-

PHYSICO-MEDICAL

AND

CHIRURGICAL TREATISE

ON THE

HUMAN EAR.

ANATOMICAL EXPOSITION

OF THE

HUMAN EAR.

EVERY one knows that the ears are two in number, one ſituated on each ſide, at the inferior and lateral part of the head. Anatomiſts commonly divide the ear into two parts, the one external and the other internal; but I find it neceſſary to be more particular, by dividing it into four. Therefore, the firſt part will conſiſt in what extends round the external orifice of the meatus auditorius; the ſecond from this external orifice down to the ſuperior part of the membrana tympani; the third from the inferior part of this membrane to the opening of the euſtachian tube in the throat; and the fourth will conſiſt in the labyrinth and its outlets.

The firſt part is ſubdivided into eminences and cavities. The eminences are four in number, called helix, anthelix, tragus, and antitragus. The helix is the large folded border, or circumference of the great portion of the ear. The anthelix is the large oblong eminence ſurrounded by the helix. The tragus is the ſmall anterior protuberance below the anterior extremity of the helix, which in adults is covered with hairs.

The antitragus is the posterior tubercle, below the inferior extremity of the anthelix. The cavities are four in number, the hollow of the helix, the depression at the superior extremity of the anthelix, the concha that lies under the rising anthelix, and ends at the external orifice of the meatus auditorius. The back part of the ear shows only one considerable eminence which is a portion of the convex side of the concha, the other portion being hid by the adhesion of the ear to the os temporis.

This part of the ear consists chiefly of a cartilage, ligaments, muscles, integuments, arteries, veins, and nerves. The cartilage is nearly of the same extent and figure with the large solid portion thereof already mentioned; but it is not of the same thickness, being covered by integuments on both sides. In the lobe, or soft lower portion of the ear, this cartilage is wanting. The ear is not only fixed to the cranium by that cartilaginous portion, but also by two ligaments, the one anterior and the other posterior. The anterior ligament is fixed by one extremity to the root of the apophysis zygomatica of the os temporis, at the anterior, and a little towards the superior part of the meatus osseus, close to the corner of the glenoid cavity; and by the other extremity, to the anterior and superior part of the cartilaginous meatus. The posterior ligament is fixed by one end to the root of the mastoid apophysis, and by the other to the posterior part of the convexity of the concha, so that it is opposite to the anterior ligament. There is likewise a kind of superior ligament which seems to be only a continuation of the aponeurosis of the frontal and occipital muscles. The principal muscles of the ear are three in number, the superior, posterior, and anterior; they are all very thin. The superior muscle is fixed in the convexity of the anthe-

lix

lix, and ſuperior portion of the concha, from whence it runs up to the ſquamous portion of the os temporis, expanded in a radiated manner; the poſterior muſcle is almoſt tranſverſe, and of a conſiderable breadth, being fixed by one end to the poſterior part of the convexity of the concha, and by the other in the root of the maſtoid apophyſis. The anterior muſcle is ſmall, more or leſs inverted, and like an appendix to the ſuperior. It is fixed by one extremity above the root of the zygomatic apophyſis, and by the other, in the anterior part of the convexity of the concha. All the other muſcles deſcribed by anatomiſts are ſo ſmall, that they hardly look like muſcular fibres. The integuments and ſkin of the ear are in general a continuation of thoſe which cover the neighbouring parts of the temporal region. The arteries of the ear come anteriorly from the arteria temporalis, and poſteriorly from the occipitalis, which is a branch from the external carotid; their correſponding veins are anaſtomoſed as they join a branch of the vein external jugularis and the vena occipitalis. The portio dura of the nervi auditorii ſends ſeveral filaments, which expand before and behind the ear. From the above deſcription, the word *ear* comprehends only that portion called by the Latins *ala*.

The ſecond part admits of no diviſion. The meatus auditorius begins at the inferior, anterior, and internal part of the concha, and ends at the membrana tympani. The diameter of the meatus is rather oval than round, and narrower at its middle part than at its extremities. Its form is ſuch, that it deſcends from behind forward, and from outward inward, but is a little curved on its length; and after its direction from below upwards, it deſcends from upwards downwards. The meatus is partly cartilaginous and, partly bony; its cartilaginous part which is moſt external, is continuous to the cartilage

lage of the concha. It is bent from bottom upward, and from hindward forward. There are likewiſe ſeveral inciſures in the circumference, which repreſent obliquely tranſverſe fiſſures; theſe inciſures are covered outwards by the *muſculus inciſuræ majoris*, whoſe fibres are ſometimes parted from each other, to form two branches. The extremity of the cartilaginous part of the meatus auditorius is adherent to the aſperities which are at the edge of its bony part. This has a little more length: it ends by a groove nearly of a circular form, bent from top downwards, and from without within, interrupted to its ſuperior and poſterior part. The two portions of the meatus are intirely lined by the common integuments which creep into it, but the thickneſs thereof diminiſhes as it draws near the membrana tympani, ſo that it is extremely thin at that part; at the ſuperior extremity, the meatus is covered with long hairs, which hinder corpuſcles and inſects to get in. The cellulary texture which accompanies them, repreſents there a kind of reticular web, whoſe eminences are full of corpuſcles of a round or oval figure, of a dark browniſh-yellow color, which are nothing elſe but ſome glands of the ſebaceous kind. Each has its excretory duct through the ſkin, which pours within the meatus auditorius, a yellowiſh, bitter humor, like a thick oil, which is afterwards changed into a hard ſubſtance by the air. This humor, known by the name of *cerumen*, lubrifies the meatus, and its more fluid part keeps the membrana tympani middling moiſt.

The inſide parts of the meatus auditorius may likewiſe be diſtinguiſhed by the external orifice; the ſuperior, inferior, poſterior, and anterior inſide; beſides, the occluſion by the membrana tympani. The external orifice varies almoſt in all ſubjects; its diameter in general is about three lines, and diminiſhes about the middle to increaſe

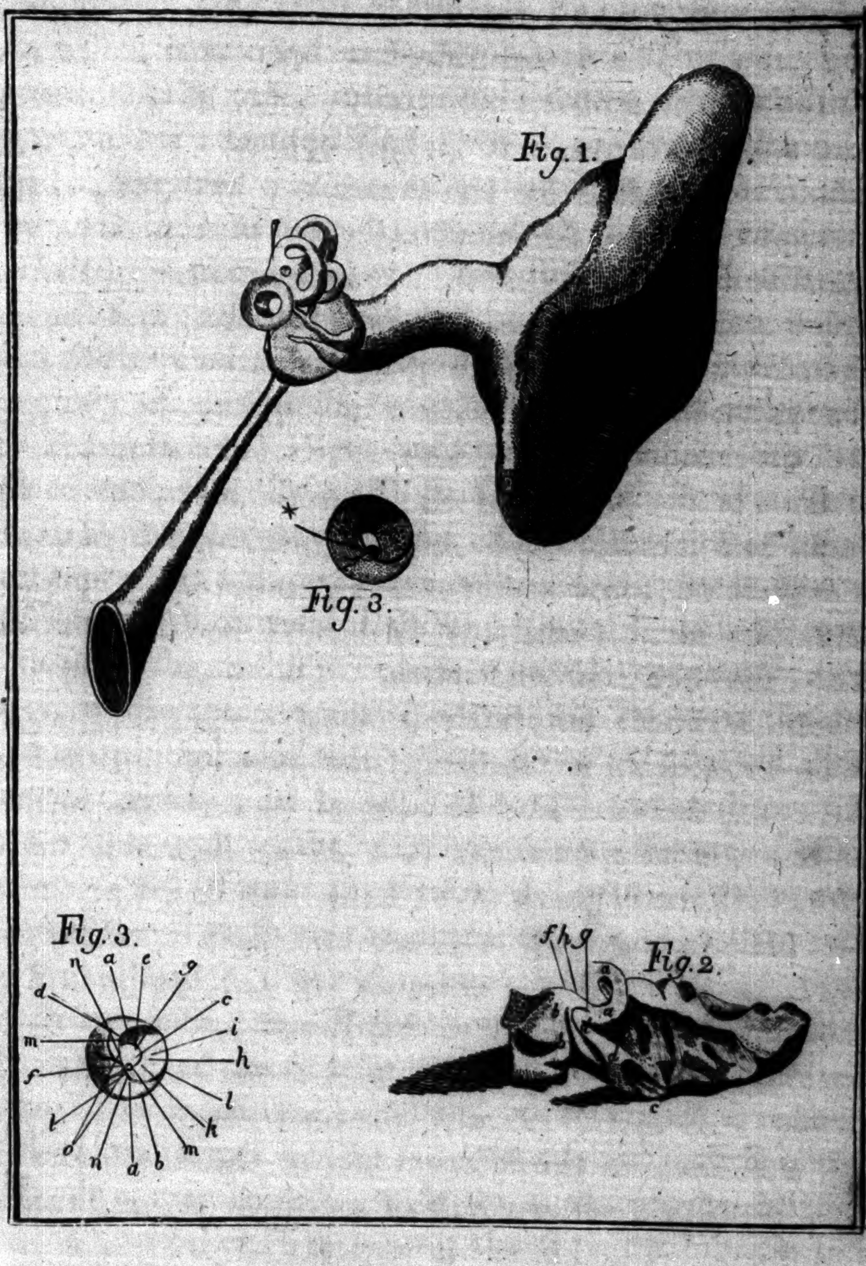
creaſe again towards the membrana tympani, to the extent of four lines: So that, the diameter of the meatus at its external orifice is leſs than near the membrana tympani. The ſuperior inſide part is in general more even and ſmooth than the others; the inferior inſide part is ſmooth from the orifice down to the middle, but further below there is a concavity, which is a kind of reſervoir for the hard cerumen, and below it a ſmall eminence ending in a round cavity till the adheſion of the membrana tympani; the poſterior inſide part is ſmooth from the orifice down to the three fourth parts, where a ſmall cartilaginous eminence is ſeen, and below is the adheſion of the membrana tympani; the anterior inſide part is in general ſmooth from the orifice down to the membrana tympani. The glands of the meatus auditorius are not equally ſpread, they are more numerous at the poſterior lateral inſide towards the cartilaginous eminence, and the membrane which covers them thinner than at any other part. Theſe glands have excretory ducts of the ſame nature as thoſe of the eye-lids called meibomius glands; the humor ſecreted through them is of a whitiſh color, which changes by degrees towards the yellowiſh brown color, and becomes hard. The membrana tympani which terminates the meatus auditorius, is thin, tranſparent and flattiſh; the edge is elevated at the poſterior inſide, declining towards the anterior, and equally fixed at the ſuperior and inferior edge of the groove. This membrane is naturally ſtretched, and middling moiſt; it is ſituated obliquely, the upper part of its circumference being turned outward, and the lower part inward. It is made up of ſeveral laminæ cloſely united together, ſupported and ſtrengthened by the chorda tympani, and ramificated by a vaſt number of varicous veſſels.

The third part comprehends the tympanum, or barrel, an

an empty cavity supported by four little bones; and the eustachian tube, with its appendix, the *velum pendulum palati*. The description of this kind of barrel, with its appendix, will be complicated, as it is absolutely necessary to comprehend the inside parts and the neighbouring ones. The tympanum has been thus called on account of its likeness to a drum, but it is rather more like a kettle drum. It is half spheric: Its upper part, which is covered by the membrana tympani, is placed outward and a little hindward; its bottom situated inward and a little forward. It incloses four small bones, called altogether officula; three eminences, and four large apertures, without including several others which cannot always be seen. The officula inclosed in the tympanum are the malleus, incus, lenticularis, and stapes. The malleus is the longest of all; it is distinguished in head, neck, and handle. The head is the thickest part of it. It represents some eminences separated by a middle cavity. Its form is oval and elongated, and is articulated with the body of the incus. The neck is short and thick. It carries anteriorly a long apophysis extremely close, to which the tendon of the anterior muscle of the malleus is fixed. The handle of that bone forms an acute angle with its neck. It is long, flattened on two sides, sufficiently thick at its basis, and blunt at the end. The malleus compact outward and lightly cellulous inward, is placed at the entrance of the tympanum; its head and neck are inward, hindward and upward, and correspond with the aperture of the mastoïd cells: The handle is situated outward, forward and downward; it descends fixed to the internal face of the membrana tympani, running over one half of its diameter, and supports it upward. This bone is articulated with the incus, whereof it is only separated by a very thin cartilaginous lamina. The apophysis which arise from the anterior

part

TAB. IV.



part of its neck determines its position, and easily tells what side it belongs to.

The incus is a little bigger, but less long than the malleus; it looks almost like one of the small molares, whereof the fangs should be a little parted from each other. It is divided in body and two branches, one superior and the other inferior. Its body forms the thickest part, it represents an oval whose diameter is from upward downward. Anteriorly there are two eminences separated by a middle cavity, which answer to those of the head of the malleus. The superior branch is short and of a pretty large thickness, its basis is conical and flattened; it rises from the superior and posterior part of the body of this bone, to extend horizontally from forward hindward. The inferior branch is long, and rises from the inferior part of the body, to descend almost perpendicularly downwards; its inferior part represents a slight curve whose convexity is outward and concavity inward, hallowed in at its last extremity to admit the os lenticularis which is commonly fixed there. The internal structure of the incus is the same as that of the malleus. This bone is situated a little more interiorly; its body is the most elevated part of it. It is hid as well as that of the malleus behind the bony and circulary groove to which the membrana tympani is fixed, and close to the entrance of the mastoïd cells. Its long branch descends almost perpendicularly downwards and in a parallel direction to that of the malleus, but it is placed more inward and hindward. Besides its connections with the malleus, it is engaged with the head of the stapes by the intervention of the os lenticularis. It is easy to distinguish the incus of one ear from that of the other, by turning the superior branch backwards and the inferior branch downwards; if the curvature of the inferior branch be towards the left hand, the

bone belongs to the right ear, if towards the right, it belongs to the left ear.

The os lenticularis is very ſmall, it is flat and a little convex on its two ſides, which anſwer, the one to the long branch of the incus, and the other to the head of the ſtapes; it would be eaſy to miſtake it for an appendix of the incus at the bottom of which it is always fixed.

The ſtapes is the moſt interior of the four oſſicula; it looks exactly like a ſtirrup. It is divided into three parts, the baſis, branches, and head. The baſis is the largeſt part, the round part is oval on one ſide, and flat on the other, as the feneſtra ovalis on which the baſis reſts; the two branches are not equal, one is of a larger curve, and the other leſs, the one is alſo anterior and the other poſterior, and this laſt a little more curve and thicker. Both branches are ſtripped on the ſide they face each other, and forms with the external face of its baſis, a groove to which is attached a very thin membrane that fills up the vacuum between them. The head of the ſtapes is ſupported upon a very ſhort neck, made up by the re-union of its two branches; it is concave at its top to receive the internal ſide of the os lenticularis. Nothing but a compact ſubſtance is to be found in the ſtructure of the ſtapes. Its ſituation is horizontal, and ſuch, that its baſis is fixed near the feneſtra ovalis, by a membranous production which ſeems to be a continuation of the perioſteum covering one and the other. The ſtapes is articulated with the os lenticularis, and by its middle with the long branch of the incus; the length, the curvature, and the unequal thickneſs of its two branches joined to its two baſis, indicates exactly if it belongs to the right or left ear.

The oſſicula above deſcribed, are covered with a very fine perioſteum, ramificated with a vaſt quantity of blood veſſels;

vessels; this kind of membrane communicating from the one to the other, strengthen their situation, and serve instead of ligaments. They are connected by some muscles which belong to the malleus and stapes. The muscles of the malleus are three; the internal, anterior, and external; the stapes has but one. The internal muscle of the malleus, tho' very thin, is however, that whose size is the most considerable; it rises by tendinous fibres from the cartilaginous part of the eustachian tube, and from the point of the os petrosa, which is between the small round foramen of the sphenoides, and the inferior aperture of the channel of the carotid. As soon as it is become fleshy, this muscle begins its adherences from forward hindward, from inward outward, and from downward upward, in a semi-bony channel hollowed in the substance of the apophysis petrosa, above the bony portion of the eustachian tube; it is inclosed there as in a sheath, and fastened by a very strong membrane. The tendon which terminates it turns round, and over a bony transverse of the tympanum, and runs from inward outwards, and a little from upwards downwards; it runs in that manner to be afterwards fixed at the inferior part of the handle of the malleus below its apophysis, and on the side which faces the bottom of the tympanum. Its use is to keep the membrana tympani in a state of tension, for if its tendon is incised throughout, the membrana tympani is immediately relaxed.

The anterior muscle of the malleus is thin; it rises from the apophysis of the sphenoides, and from the external neighbouring part of the eustachian tube by very short tendinous fibres. Its fleshy body re-ascends from inward outward, and from forward hindward and adheres in the articulary sciffure of the os temporis, thro' which it creeps within the tympanum. Before it is at that

place, it ends by a tendon which adheres to the extremity of the apophyſis of the malleus.

The external muſcle of the malleus looks rather like a ligament, tho' it is properly a muſcle. Its ſituation is at the internal ſuperior, and poſterior part of the meatus auditorius. Its fibres aſſemble together to form a tendon which runs from upwards downwards, from forward hindward, and from outward inward; and penetrating within the tympanum by the weak ſide of the circulary groove where the membrana tympani is adherent, it becomes fixed at the external part of the neck of the malleus. The uſe of the external muſcle is to keep the membrana tympani in a ſtate of tenſion outward, otherwiſe it would lean too much on the malleus.

The muſcle of the ſtapes is the ſmalleſt in the human body. It riſes from the pyramidal cavity of the poſterior and ſuperior part of the tympanum. The tendon which terminates it, goes out by the hole of that pyramid, and takes its adheſion at the convexity of the long branch of the ſtapes, near the head of that os. The ſituation of this muſcle ſtretches the membrana tympani. The chorda tympani goes under the ſhort branch of the incus, and paſſing between the long branch of this bone, and the ſuperior part of the handle of the malleus, it aſcends from downwards upwards, and from hindward forward to the very place of the inſertion of the tendon of the internal muſcle of the malleus; after it has contracted ſome adherences with this tendon, and ran above it, the chorda tympani increaſes in ſize and becomes firm, and deſcends with that of the anterior muſcle of the malleus to go out of the tympanum through an aperture very near that by which this tendon is introduced.

The perioſteum of the tympanum is very thin; that which covers and unites the oſſicula is a continuation of it, as well as the membranes which cloſe the feneſtra

ovalis

ovalis and feneſtra rotunda. It produces likewiſe the perioſteum of the maſtoid cells, and adheres to the internal tunic of the euſtachian tube; the perioſteum is ramificated by a prodigious quantity of blood veſſels. Theſe are the containing and contained parts of the tympanum, as they appear in diſſections; but I muſt not forget to mention here, that there is but one free opening out of the tympanum, and that is the euſtachian tube, which is a ſort of appendix to the tympanum itſelf. The feneſtra rotunda and feneſtra ovalis, are cloſed, as I ſaid above, by a thin membrane or pellicle; the firſt leads to the internal part of the cochlea, and the ſecond to the veſtibulum.

The euſtachian tube, or *ductus auris palatinus*, is a duct which goes from the tympanum to the poſterior opening of the palate; it is dug in the apophyſis petroſa along the carotid canal, and lengthened out by the ſpinal apophyſis of the os ſphenoidale. In its natural ſtate, this duct reaches from the cavity of the tympanum to the root or ſuperior part of the internal ala of the apophyſis pterygoides; and through this whole courſe it is made up of two portions, one entirely bony, and the other partly bony, partly cartilaginous, and partly membranous. The bony portion lies through its whole length, immediately above the fiſſure of the glenoid or articular cavity of the os temporis, and terminates at the meeting of the ſpinal apophyſis of the os ſphenoidale with the apophyſis petroſa of the os temporis, that is to ſay, between that ſpinal apophyſis and the inferior orifice of the carotid channel. The other, or mixed portion, reaches in the ſame direction from this place to the internal ala of the apophyſis pterygoides, or to the poſterior and outter edge of the nares; but to have a more exact idea of it, it will be proper to conſider it as divided into four parts, two ſuperior and two inferior. The two upper

parts

parts are bony, and, of these, the innermost is formed by the side of the apophysis petrosa, the outermost by the side of the apophysis spinalis of the os sphenoides, so that the upper half of this portion of the eustachian tube is bony. Of the two inferior parts, the internal is cartilaginous, and the external membranous, so that the lower half of this portion of the tube is partly cartilaginous next the os sphenoidale, and partly membranous next the apophysis petrosa. The eustachian tube is thus formed: it is at first wide enough, and towards the middle it gets narrower, and afterwards wider and wider. It is at first flattened on its two faces, so as to be a little oval, and finishes by being like the lower extremity of a French-horn, a musical instrument well known. The cavity of this tube is lined by a soft, thick, reddish membrane, like that of the internal nares, of which it appears to be a continuation, and which becomes more firm as it goes towards the tympanum. Its external orifice opens behind the uvula, and the *velum pendulum palati* which rises up hindward in stopping up the posterior nares during deglutition, hinders the aliments to get into it.

The fourth part comprehends the labyrinth and the closed openings which lead into it, and out of it. The labyrinth is made of several cavities which communicate together, and these are distinguished in vestibulum, cochlea, semi-circular canals. The aqueducts are two outlets, which lead in the cranium.

The form of the vestibulum is almost spheric; this cavity is situated beyond the tympanum, whereof it is separated by the fenestra ovalis. It is more spacious forward than hindward. The bottom is divided into two slight excavations, one inferior, neighbour of the anterior extremity of the fenestra ovalis, whose form is round; the other superior, of a long form, which extends from forward

forward hindward, called ſemi-oval. The firſt is the deepeſt, and ſeems to be of a bony ſubſtance, more white and compact than the other. They are ſeparated by a bony point, which riſes from the inſide of the bottom of the veſtibulum, and goes forward and outward. This point is terminated towards the middle of the ſuperior edge of the feneſtra ovalis by a bony pyramid, but very ſmall, whoſe baſis is triangulary, and the top flattened and a little rough. The veſtibulum preſents ſeven apertures, one is the feneſtra ovalis, the ſecond belongs to the cochlea, and the five others to the ſemi-circular canals.

The cochlea takes its name from the reſemblance of a garden ſnail. It is ſituated exteriorly as to the other parts of the labyrinth. It is diſtinguiſhed by a baſis, which is hindward and forward, towards the bottom of the bony duct wherein are admitted the two portions of the auditive nerve ; and by a top which is forward and outwards, on the ſide of the euſtachian tube : The baſis is likewiſe a little more elevated than the top ; it is hollowed and bored by ſeveral holes which communicate within the cavity of the cochlea. This cavity repreſents a double ſpiral, which at firſt turns round a common axis, which is bony and of a conical figure, and terminates towards the middle of the length of the cochlea, by a kind of funnel, exceſſively large at the end. It makes two turns and a half ſeparated from each other by a partition entirely bony, which is called the partition of the windings to diſtinguiſh it from another bony partition on the ſide of the common axis, membranous on the ſide which faces the oppoſite inſide of the cavity, which is called half partition. This laſt is flexible and thin, that of its two ſides which faces the veſtibulum is unequal and rough, whereas that the one which faces the tympanum preſents jutting out lines, ſet in like rays.

rays. At the place where the common axis fails, the half partition adheres to the inſide of the funnel; it is totally membranous at its laſt extremity, where a very viſible apperture is obſerved. The half partition mentioned before, ſeparates the ſpiral part of the cochlea, into two very diſtinct parts; the one is internal and near the baſis of the cochlea, the other is external and placed on the ſide of its point. The firſt is larger but ſhorter, terminates at the feneſtra rotunda; the ſecond narrower and longer, opens to the inferior and anterior part of the veſtibulum: they are called *ſcala tympani* and *ſcala veſtibuli*; they have communication together. The form of the cochlea of the right ear is like that of all ſhells; that of the left cochlea is contrary ways, by that difference they are diſtinguiſhed from each other.

The three ſemicircular canals ariſe from the veſtibulum, and return in it after they have gone a little way in the ſubſtance of the apophyſis petroſa. They offer to our view but five appertures within the veſtibulum, becauſe the two longeſt unite to form but one common canal. The names by which they are diſtinguiſhed, take their origin from the ſituation. The firſt is the ſuperior vertical, the ſecond the poſterior vertical, and the third the horizontal. The ſuperior vertical canal ariſes from the anterior ſuperior part of the veſtibulum, and after riſing above the others, it forms a perpendicular curve to the horizon; it goes towards the poſterior part of the veſtibulum, and opens there with the poſterior vertical. Its anterior orifice has an elliptic form, and more lengthened hindwards than forwards; its cavity is equally elliptic, and longer forwards than hindwards: Its length keeps the middle between that of the poſterior, and that of the external. The vertical poſterior canal ariſes where the ſuperior ends; it is at firſt united to it, and forms with it a common canal of a line and

and a half long, the cavity thereof large enough at the beginning, afterwards becomes narrower as a funnel, and terminates by an aperture which is obſerved at the poſterior and internal part of the veſtibulum. It is the longeſt of the three. The horizontal canal is almoſt parallel to the horizon; it is ſituated between the ſuperior and poſterior. This canal ariſes anteriorly from the ſuperior part of the veſtibulum, between the orifice of the ſuperior vertical, and the feneſtra ovalis, and ends at the poſterior part of that cavity, between the common canal and the inferior part of the poſterior vertical. Its anterior orifice is large, elliptic, and ſeparated from that of the ſuperior vertical by a little bony protuberance; the poſterior is narrower and rounder. This difference of diameter is viſible in its whole length, for its anterior half portion is the largeſt; it is the ſmalleſt of the three.

All the parts of the labyrinth are covered with a very thin perioſteum, over which creep ſome blood veſſels and a vaſt quantity of nervous ramifications, and filled up with a limpid ſeroſity undoubtedly furniſhed by ſeveral excretory ducts neither to be perceived nor known at preſent; ſo that they are one of the *inquirenda* in anatomy. This ſeroſity is of the ſame nature as that of the aqueous humor of the eye; when it is too full, or copious, it runs out of the labyrinth by two aqueducts, called *cotunnii aquæducti*. The firſt has its orifice at the bottom of the veſtibulum, below that of the common canal, near the protuberance which divides the cavity I am ſpeaking of. The aqueduct of the veſtibulum riſes from downward upward in the ſubſtance of the apophyſis petroſa, in paſſing behind the common canal. When it has run the length of three parts of a line in that direction, it curves hindward and forward, and ends at the poſterior ſide of the os petroſa below the middle part of its ſuperior edge, by a criſe of two lines and a half long, and

a quarter of a line wide, and whose superior edge is raised up. The diameter of that aqueduct is not alike in its whole length; it decreases from its orifice to the place of its curve, where it is very narrow; afterwards it widens very much, and looks very much like the large opening of a French horn which would be a little flattened. Its length is about three lines. It is entirely lined with a membrane which comes from the external lamina of the dura mater, and is continuous to the periosteum of the vestibulum; in so much that we might say it arises from the dura mater. At the place where it opens in the cranium, the internal lamina of the dura mater is parted from the external, and a small cavity of a triangular form between them is observed to be continually filled with some aqueous humor.

The aqueduct of the cochlea has its orifice at the inferior part of the fenestra rotunda. It is the beginning of a very narrow bony canal, hollowed in the substance of the os petrosa, which is always dilated, and goes from upward downward, for the distance of about three lines, ends in the cranium below the internal auditive foramen, by an aperture whose form is triangular, a little flattened, and sufficiently wide. This canal is interiorly lined by the dura mater, which is continuous with the periosteum, in the internal part of the cochlea. The aqueous humor detained in the cochlea goes through the canal in the cavity of the cranium, and supposed to be soon absorbed like the other fluids therein contained.

The fenestra ovalis is situated at the bottom of the tympanum; superiorly it is oval, and flat inferiorly. This aperture leads to the vestibulum, one of the cavities of the labyrinth. It is closed by the continuation of the periosteum, and fastened by the basis of the os stapes, which rests on it. The fenestra rotunda is smaller than the fenestra ovalis; it is situated below this last aperture,

aperture, whereof it is ſeparated by a protuberance. It is inclined backward, and cloſed by a thin membrane, which is not a continuation of the perioſteum as that of the feneſtra ovalis, but a very thin pellicle, very much like a wet ſilk paper. It is ſet and faſtened round the edge by a great many blood veſſels, and is contiguous to the perioſteum of the tympanum, eſſentially different from it, and well adapted for its particular purpoſe.

The arteries which penetrate in the internal parts of the ear are numerous and multiplied by very ſmall ramifications. They come from the occipitalis, the poſterior auricularis, the meningea, external and internal carotid, *&c.* The poſterior auricularis ſending more branches in the ear than any other mentioned, ſhall be particularly deſcribed. The veins are not ſo numerous, as there are many branches of the arteries which have neither venæ vorticoſæ, nor immediate correſponding veins. The nerves of the internal ear are the portio dura and mollis.

The poſterior auricularis is not very ſmall; it ariſes from the external carotid, ſometimes from the occipitalis. That artery goes from forward hindward, and almoſt tranſverſally on the digaſtric, then under the apophyſis ſtyloid in giving ſome branches to the neighbouring parts, when it is at the ſuperior orifice of the meatus auditorius, it produces another which penetrates within the meatus in paſſing through a hole of the cartillage that forms it. That artery, as I ſaid above, ariſes ſometimes from the occipitalis, and very ſeldom from the very trunk of the external carotid. Before it arrives at the ſtylo-maſtoid hole, it ſends a few ramifications to the inferior part of the meatus auditorius, and produces one of the trunks of the artery which runs over the membrana tympani, called arteria tympanica: arrived within the aquæductus fallopii, it ramificates over the maſtoid

cells,

cells, the muscle of the stapes, the semi-circular canal, on the periosteum which lines the aqueduct itself, and over the insides of the cavity of the tympanum.

The veins of the internal parts of the ear are few in number. The vestibulum and cochlea have each their respective ones, which open in the lateral sinus and the main trunk of the internal jugulary: The trunk of that of the cochlea, is very near the orifice of its aqueduct; it takes up several branches which come from the internal cavity of the labyrinth. The vein of the vestibulum is likewise near neighbour of the aqueduct above described; the ramifications which form these trunks come from the cochlea and the semi-circular canals, and pour out the blood in the jugulary vein.

The nervi auditorii, are nerves of the seventh pair; they arise from the lateral and posterior part of the great transverse protuberance of the medulla oblongata. Each of these nerves is double, which accompany each other very closely to the foramen auditorium of the apophysis petrosa, through which they pass with some small arteries along the foramen, and part from each other at its extremity. The portio mollis is divided into three branches, which penetrate at the basis of the cochlea, and are spread there in very small filaments on the surface of the periosteum.* The portio dura is totally different from that of the mollis. A branch of this nerve penetrates within the tympanum, by an aperture situated at its superior and posterior part, near the basis of the pyramid; it goes under the short branch of the incus, and passing between the long branch of that os, and the superior part of the malleus, it ascends from downward upward, and from hindward forward, to the very place of the insertion of the tendon of the internal muscle of the malleus: It runs over this tendon to which it is fixed,

* Objection to Dr Monro's Nervous System.

ed, and becomes thicker and of a firmer consistence; then it descends with that of the anterior muscle of the malleus, and goes out of the tympanum by Glasser's fissure, between the apophysis of the sphenoid and the neighbouring parts of the os petrosa: It is the chorda tympani. This nerve continues to go from upward downward, from hindward forward, and from outward inward, until it meets the lingual nerve of the inferior maxillary to which it unites in forming forward a very acute angle, and augments the bulk; this shows that the chorda tympani goes from the portio dura of the nervi auditorii to the lingual nerve. This portio dura furnishes other nervous ramifications, an account of which may be omitted here, as it becomes foreign to this treatise.

PHYSIO-

PHYSIOLOGICAL ENQUIRY

INTO THE

ORIGIN OF SOUNDS

AND THE

MECHANISM OF HUMAN HEARING.

HAVING defcribed all the parts which enter into the compofition of the human ear, without mentioning their particular and general ufe towards the mechanifm of hearing, I am now to open a new field to the inquifitive phyfiologift, and illuftrate many fyftematical points which feem to have embarraffed the authors who have wrote on founds, their difference, propagation, and their fenfation on our organ. In this theory I have not been able to get great affiftance from antient and modern authors, their fyftems being without exception contradictory to facts; therefore the reader will eafily apprehend at what pains I have been to extort, as it were, the truth from anatomy on the one hand, and on the other raife a new theory confiftent with the different difeafes of the organ. The origin of founds and their propagation,

propagation, require my attention in the firſt place, and their ſenſation on our organ next to it, to avoid repetitions and prolixity.

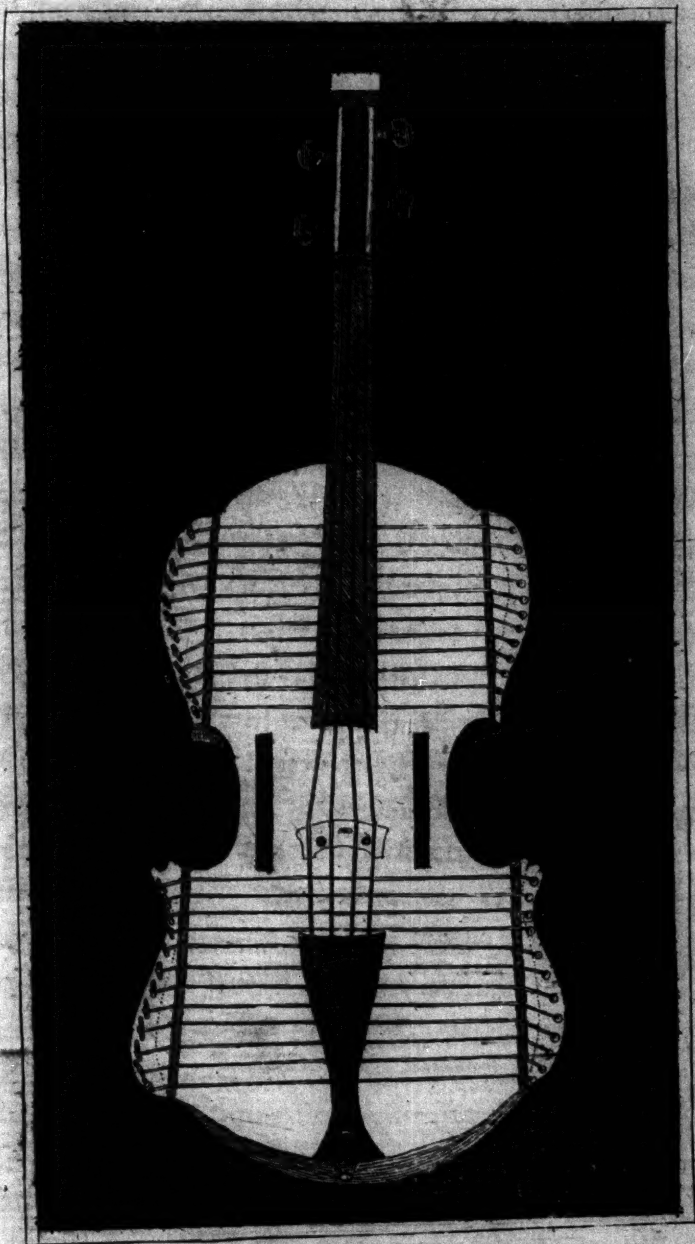
Sounds are vibrations of the air excited by the concuſſion of ſolid bodies; there are ſeveral kinds whoſe impreſſions we ſenſibly diſtinguiſh from each other. The low and loud; the ſhrill and ſoft: theſe four ſpecies compounded properly together, form melody. They have all a different principle or origin. The writings on harmonic ſounds, from Rameau down to Matthew Young of Trinity College, Dublin, an author perhaps not generally known, have indeed given us the theory of modes, but they have ſaid nothing concerning the origin of the difference in thoſe ſounds; this point in particular has required many experiments, and how right I have drawn concluſions from them, I have not vanity to determine. But before to proceed by deducing the arguments which tend to prove that the concuſſion of ſolid bodies moves the air in form of waves, and that theſe aſſume the ſhape of different angles, the effect whereof I conſider unaccounted by philoſophers and muſicians, I ought to deſcribe the inſtrument conſtructed for the purpoſe of aſcertaining that ſame principle or origin of difference in ſounds.

The inſtrument I mean is conſtructed upon the ſame plan as a common violin, except that it is perfectly flat, and its openings, inſtead of being in form of § are ſtraight and parallel; beſides it has 24 wire ſtrings, 12 under the tail-piece, and 12 under the finger-board. On the right ſide, the wire ſtrings are attached to braſs pins with ſmall heads, and on the left, with iron pins like thoſe of a harpſichord. Theſe braſs nails and iron pins are fixed on a piece of wood, about half an inch ſquare, and four inches long, framed or ſhaped like the rims, glued upon them, and even with the belly. The

24

24 wire ſtrings are ſupported by four very low bridges placed and glued on the belly of the violin, near the iron pins and braſs nails. I call that inſtrument *harmonica violin;* it has a moſt agreeable tone, and is, I believe, ſuperior to the very beſt common violin. Matthew Hardie, of Edinburgh, made it in the year 1786, but I muſt obſerve that I altered it at the bar, which at firſt reſted by each end on the blocks in the inſide, ſo that the bar is quite ſquare, and extends the whole length of the violin, except half an inch near each block. The four ſtrings of the violin being tuned the common way D natural, which is ſounded by the third ſtring open, will make uniſon with the loweſt wire ſtring under the tail-piece; for example: D natural, ſhall be the tuning of the loweſt and firſt wire ſtring, the ſecond E flat, the third E natural, the fourth F natural, the fifth F ſharp, the ſixth G natural, the ſeventh A flat, the eight A natural, the ninth B flat, the tenth B natural, the eleventh C natural, the twelfth C ſharp. Theſe twelve tones form a complete octave, in whatever key one plays on the *harmonica violin*, and produces the ſweeteſt tones that I ever heard. The other twelve wire ſtrings under the finger board are tuned in continuation of the above, ſo that the whole 24 wire ſtrings make two perfect octaves; and I muſt further obſerve, that it will keep in perfect tune for 14 or 16 days, when the inſtrument has been conſtructed ſix months. The four loweſt ſtrings are of the ſize and nature of the fourth ſtrings for a ſmall guittar; the four following of the nature and ſize of the third ſtrings of a large guittar; and the four laſt of this octave are of the nature and ſize of the third ſtring of a middling guittar. The four loweſt of the twelve under the finger board, are of the ſize and nature of the third ſtring of a ſmall guittar, the four following of the nature and ſize of the ſecond ſtring of a middling guittar, and the

TAB. V.



VIOLINA HARMONICA

the four laſt of the nature but ſmaller ſize of the firſt of a ſmall guittar. The violin is painted with oil color, and covered with one coat of copal varniſh.

As ſounds are produced by the concuſſion of ſolid bodies, and propagated by the air fluctuating different ways, according as the ſolid bodies move it, the difference in the fluctuation of the air ought to operate variety in ſounds: For example, if any ſolid body moves the air in acute angles, the ſound produced and propagated will be ſhrill and offenſive to our organ, when near; if, on the contrary, the air is moved in obtuſe angles, the ſound will be ſoft and agreeable to the ear. I ſhall have occaſion to prove, in the courſe of this Phyſiological Enquiry, that the membrana tympani has no power of moderating the ſhrillneſs of ſounds, by aſſuming a different degree of tenſion; conſequently, the ſeveral degrees of acuteneſs and obtuſeneſs the waves of the air do aſſume, ſhall undoubtedly conſtitute and account for the variety of all ſorts of ſounds. This motion or waving of the air was generally underſtood by the word *vibration*, but there was no account with regard to its difference in producing variety of ſounds. The low and loud ſounds have their origin in the degree of concuſſion and quality of ſonorous bodies, and their propagation by the more or leſs velocity of theſe vibrations; in this manner, every kind of ſound will be explained, together with their origin and ſenſation on the organ of hearing.

When I play on the harmonica violin, *God ſave the King*, in C natural, the firſt note of the firſt bar being C, it is repeated by each C natural in the octaves of the wire ſtrings; the third note of the ſame tune and bar being D natural, it is repeated by the third ſtring open, and the two D in the octaves of the wire ſtring; ſo that there are four notes or tones in uniſon at the ſame mo-

ment; and if we reflect on Tartini's system on grave harmonics, in the same manner as Rameau derived his from the acute, we will naturally conclude that all the discording tones are really acute. Why do not all strings vibrate when not in unison with the sound produced? The weakest part of any tight string is undoubtedly its middle; therefore, any sound propagated through the air cannot shake one that should be more or less tight than itself; and this is the reason why some strings receive and generate their vibrations to such only as are susceptible of assuming the same degree of angle, whilst those that are not, remain quiescent. It follows, that a tight string, when in vibration, will form more acute angles than one that should be slack. Strings which vibrate in acute angles, propagate these angles to the air, and as they go from it, become less and less acute, till they in some degree assume an obtuse angle, on account of the opposition of the air; from that alteration, shrill sounds become less disagreeable, when their sensation is felt by our organ at a great distance; consequently, the difference between shrill and acute sounds, comes from the difference in the angles.

Experience tells us, that high notes executed on the first string of the violin in shifting, are acuter than those of the back strings; and this is the reason why, in accompanyments, the same notes, executed on the second or third string, by great players, are always preferred, though the running notes should not be discordant. A note which contains a full tone, contains near 200 different tones, and as in an octave there are seven full tones, the whole shall comprehend 1400 different tones; consequently, as there are but 12 tones which are consistent with melody, there ought to be 1388 discordants in the whole octave. A false string will assume the same angles in its vibrations as a true one, but they shall cease or die away in an irregular

regular manner on account of its natural defect in point of size or compactness; from those irregular vibrations, the melody produced by it will become disagreeable, as if that same string should be continually stopped out of tune. I have likewise observed, that whenever several strings are tuned differently, they are not capable of receiving the same vibrations, unless the vibration propagated to them assume the same equal angle; consequently such strings as are capable of assuming angles adequate to that which will communicate its own, shall vibrate, and such as are not of the proportionate angle shall remain quiescent. But why does the *harmonica violin* increase in tone, by the addition of all the wire strings, since none but these which are in unison, and become harmonics on playing the instrument, are in vibration, whilst the greatest number of them remain quiescent? To this I answer, that all the quiescent strings, being in contact with the instrument, receive a tremor or single vibration, which cannot be continued, as these strings can but assume each an angle adequate to their tightness: This explains discord, if that or any quiescent string is vibrated by a different cause than the unison. But why are tones generated without friction? Because a sound or tone forms an angle which will be communicated only to, and propagated by such strings as are tuned in unison to it: A string tuned to any pitch cannot continue to vibrate to all sounds indistinctly, as all different sounds move the air in different angles; in this manner the origin of sounds, and their difference, are no longer suppositions.

The main point understood, it remains to know, how and in what manner sounds could arrive at that part of the cochlea, *the immediate organ of hearing*, and produce there a sensation, so as to be afterwards conveyed to the brain. This function of the ear becomes my next enquiry.

quiry. I have often ſearched in the labyrinth, and particularly in the cochlea for a ſoft and tender nervous expanſion ſimilar to the retina of the eye, as the late Dr Monro mentions in his anatomy of the ſkeleton to have ſeen; but I have been always diſappointed, becauſe I looked for an imaginary object. I repeatedly poured the ſtrongeſt ſpirit of wine in all the cavities of the labyrinth, and I could find nothing but nervous ramifications, without that theſe did form a continuous coat; ſo that the ſenſe of hearing is operated in a different manner from that of ſeeing. The rays are emitted from objects, and ſuſceptible of being intercepted; ſounds are vibrations of the air, but cannot be ſo eaſily intercepted as I will aſcertain it hereafter by diſſections and caſes. In order to leave no room for conjecture, and to go upon ſure ground, my firſt enquiry into this difficult matter was to conſider, which part of the ear is moſt probably the immediate organ of hearing; to which purpoſe I cautiouſly followed the *nervi auditorii* to their very extremities; and having obſerved that the *portio mollis*, after ſeveral ramifications ſpread in the cavities of the labyrinth, aſſembles a greater quantity of them at the baſis of the cochlea, I naturally concluded, that this particular place of the cochlea muſt be the immediate organ of hearing.

Dr Alexander Monro, in his obſervations on the ſtructure and functions of the nervous ſyſtem already quoted, page 11. and 40. has the following paragraph, chap. XVII. ſect. i. p. 45. "In like manner, I have diſcovered in "the ear, that the branches of the portio mollis form, "upon the membrane and ſcala of the cochlea, a moſt "elegant plexus; in which the nervous filaments are "ſo intermixed as to form new combinations, ſo far as "they can be traced with glaſſes, and ſeem at laſt to "terminate in a retina or web, ſomewhat reſembling "that formed in the eye by the optic nerve." If we compare

compare this deſcription with the fourth figure of the thirty firſt table in that work, we plainly ſee the Doctor in contradiction with himſelf. The retina is a nervous coat of itſelf, and this is ſo evident, that when dipt in ſpirit of wine, it will reſiſt pulling very near as much as a piece of wet paper. I have many times extracted this nervous membrane, and obſerved it with the microſcope. It is certainly not ſupported by the pia mater, for this laſt coat is contiguous to the choroides, where it undoubtedly ends; conſequently, it is obvious that the retina is only ſpread on the choroides, ſupported betwixt this vaſcular membrane and the poſterior part of the vitreous body, and ſuſtained by a multiplicity of lymphatic arteries which have their paſſage through it. When we look with attention at the nervous ramifications of the portio mollis in the cochlea, with or without glaſſes, we find that theſe ramifications are ſpread in and over a membrane ſimilar to the dura mater; therefore, the Doctor's compariſon is by no means admiſſible, for theſe nervous filaments, even deſcribed by his own plate, magnified to about thirty diameters, are laterally contiguous to each other, whereas the retina has no filaments, but forms a continuous nervous coat.

This information obtained was not yet ſatisfactory; it remained to explain how, and in what manner the vibrations were carried from the membrana tympani to that of the feneſtra rotunda, and from this laſt membrane to the baſis of the cochlea: Becauſe all the authors have advanced, that the oſſicula in the tympanum were appointed for that purpoſe, as the os ſtapes does immediately reſt on the feneſtra ovalis, which leads to the cochlea, as well as the feneſtra rotunda. It became, therefore, a matter of doubt to the phyſiologiſt, which of the two ways nature has thought proper that the vibrations ſhould be communicated to the immediate organ

of

of hearing. If the officula were the agents of communication between the membrana tympani, the feneſtra ovalis, and the baſis of the cochlea, it ſhould naturally follow, that the officula being extracted out of the tympanum, the ſenſe of hearing could not take place; however, it is by no means the caſe, for I have often met with diſeaſes where the officula and membrana tympani were entirely deſtroyed, and yet the organ was not deprived of the faculty of hearing. Monſ. Bertin ſays, that he knew a young man who heard tolerably well, although the four officula had exfoliated after an abſceſs in the tympanum. If the officula are not the agents of communication between the membrana tympani and the immediate organ of hearing, what is their uſe? When I had been informed that the officula were not abſolutely neceſſary to the operation of the ſenſe of hearing, it was not very difficult to find out, why they were only acceſſary, and appointed to ſome other particular purpoſe.—The reader ought to recollect here, that the labyrinth is filled with a limpid humor, and that there are two aqueducts to let it out from all its cavities, one at the bottom of the veſtibulum, and the other below the inferior part of the feneſtra rotunda; the aqueous humor contained in the cavities of the labyrinth cannot evacuate through theſe aqueducts, unleſs it is forced out by ſome aſſiſtance, otherwiſe the ſenſe of hearing muſt be either impaired or ſuſpended if the evacuation ſhould eaſily take place; conſequently, whenever the labyrinth is too full of that limpid humor, the membranes of the feneſtra ovalis and rotunda are puſhed out in the tympanum, but that of the feneſtra rotunda in a greater degree, becauſe the other is ſupported by the baſis of the os ſtapes. In this caſe the ſenſe of hearing becomes imperfect on account of the ſtretch of theſe membranes, until we move either voluntarily or unvoluntarily the *muſculus levator*

auricula

auricula, to put the officula in action, that the os ftapes may prefs on the membrane of the feneftra ovalis, and fo help the limpid humor out of the cavities of the labyrinth, through the aqueducts, in the cranium.— The officula are likewife fet in action, for that particular function when we fhut and open our jaws, and more effectually when we are gaping or blowing forcibly our nofe; when we apply the tip of our finger to the external meatus, by compreffing the air contained in it, which moves the membrana tympani, and of courfe the officula: And it is owing to thefe motions that hard hearing people hear better, when they open their mouth very wide, or excite the officula to action, which forces the limpid humor out of the labyrinth, than by the intromiffion of founds through the euftachian tube, as fhall be proved in the fequel. As foon as this evacuation takes place, we feel it fenfibly by a pleafing ejaculation of the limpid humor, out of the cavities of the labyrinth, which founds within our ears like a kettle very near boiling, and at the fame time we are fenfible of an improvement in our hearing, confidering its ftate anterior to it. I imagine, that when we are overcome by fatigue, our mufcular faculties being exhaufted, this action of the officula being quiefcent, a finging within our ears ftupifies our fenfes and lulls us a fleep, which no ordinary noife will be able to difturb, till by a refrefhment, the officula reaffume their action, and, by the means of the ejaculation, render us fenfible of any noife, and then we awake.

When the officula are either deftroyed or unable to act their part for that particular function, this evacuation or ejaculation may however be effected, but very improperly, and not without fome detriment to the fenfe of hearing: For example, if the officula are exfoliated from the tympanum with or without the membrana tympani, if they

they are dislocated or injured by any cause whatever, the membranes of the fenestra ovalis and rotunda shall become two conveyances for the sounds, and, in case of exfoliation, these will resist, as much and as long as it lays in their power, the impulsion of the limpid humor. If the officula are dislocated, and in their natural situation, the organ shall not suffer so much as the total want of them, but the sense of hearing will be impaired in proportion to the relaxation of these membranes, or the inaction of these small bones. These several accidents account for the hardness and loss of hearing, when the patient shall have laboured under abscesses in the tympanum, the dislocation of the officula, and their exfoliation. If the officula are existing, and unable to action for want of free articulation, or any other cause, this limpid humor being retained in the labyrinth, shall become too voluminous, and press or annoy the immediate organ of hearing; in that case, a singing, or hissing noise in the ear will take place, with or without any other accidents, and produce dullness. It was absolutely necessary that the fenestra rotunda should be smaller than the ovalis, because the first is better enabled to resist the impulsion of the limpid humor, otherwise it would burst, and occasion instant deafness; besides, I looked upon this foramen and its membrane as a sort of pupil to moderate, or direct the angles of the vibrations of air. The fenestra ovalis being larger, the stapes has more power over its membrane, and of course presses a greater column of the limpid serosity, what operates more effectually the evacuation through the aqueducts.

The tympanum in its natural state is a perfect empty cavity, except that part which is taken up by the officula. The membrana tympani which covers the tympanum is naturally moist and stretched; if that was not the case, the sensation could be but imperfectly conveyed in the cochlea,

cochlea, as it becomes impaired or diminiſhed in proportion to the dryneſs and relaxed ſtate of that membrane. From this aſſertion, grounded on a variety of caſes, a multiplicity of queſtions naturally ariſe. Does the tympanum fill with fluids when the euſtachian tube is ſhut or obſtructed? Could the membrana tympani keep its natural tenſion, when the oſſicula are diſlocated, looſe, deſtroyed, or evacuated through the euſtachian tube? Would it be a detriment to the ſenſe of hearing, if the os ſtapes did not reſt on the feneſtra ovalis? Are the oſſicula a kind of bracers to the tympanum?

Anſwer to the firſt queſtion: Whenever the euſtachian tube is cloſed, (what is eaſily known by blowing in the ears, in ſtopping both noſe and mouth) the membrana tympani becomes dry, and loſes part of its communicative powers; therefore the tympanum is a vacuum at all times, whether the euſtachian tube be open or cloſed, unleſs it be moiſtened by ſome matter ariſing from abſceſſes, either on the coats which line the cavity, or retained there for want of a free paſſage in the throat. When it is open, the *velum pendulum palati* prevents any moiſture or extraneous bodies from getting in, as, at every motion of deglutition, this velum pendulum covers the euſtachian tube; conſequently, the moiſture of the membrana tympani does not come, or is not kept up by any fluid in the tympanum, but by the moſt fluid parts extracted from the cerumen, the groſſeſt of which are ſent off, or kept up by a compreſſion of the air contained in the tympanum, every time we ſwallow our ſaliva, blow our noſe, *&c.* This oily fluid, dripping or flowing uniformly, and round the external part of the membrana tympani, proves, that it is not fit to coincide in the operation of the ſenſe of hearing when in a dry ſtate ſince thoſe whoſe ears are continually dry

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and deprived of cerumen, become either hard of hearing or deaf.

Anſwer to the ſecond queſtion: Whenever the oſſicula are diſlocated, diſplaced, or looſe in the tympanum, the membrana tympani being very thin, and always moiſt, will undoubtedly loſe its tenſion; in the firſt inſtance, this is known by blowing in the ear as I mentioned above, for when the perſon does ſo, he ſhall regain his hearing, if a kind of ſnap is heard within the ears; in the ſecond it will be known, if motions of the oſſicula are not ſenſibly felt, as otherwiſe it will in the third inſtance. In caſe of evacuation of the oſſicula through the euſtachian tube, the patient ſhall either have been deaf a good while before, or experienced dreadful pains within the ear, or at leaſt very dull, if the caſe be but recent.

Anſwer to the third queſtion: Whenever the baſis of the os ſtapes does not reſt on the feneſtra ovalis by either of the cauſes above mentioned, and looſe in the tympanum, the vibrations are communicated to the immediate organ of hearing by the feneſtra ovalis and rotunda at the ſame time; then the perſon's ear, thus diſordered, becomes giddy at a common noiſe, as if it were the report of a gun: Therefore, the intention of nature, in placing the os ſtapes on the feneſtra ovalis, was to deafen that communication, the feneſtra rotunda being quite ſufficient for the purpoſe of diſtinct hearing.

Anſwer to the fourth queſtion: The oſſicula, in my opinion, cannot be looked upon as bracers of the tympanum unleſs it be permanent, ſince their poſition and action do not indicate ſuch a function, as the membrana tympani does not alter its tenſion at any particular ſound. This opinion having been generally adopted by modern anatomiſts and phyſiologiſts, I have taken down all the caſes which directly contradict their ſyſtems.

From

From the anatomical defcription of the ear and its phyfiology, it appears that the fenfe of hearing is operated in the following manner: As foon as any folid and fonorous body fets in motion the furrounding air, found is effected; and according as the air is fet in motion in more or lefs obtufe angles, the refult is more or lefs grave or foft tones: confequently the founds, which arrive on the membrana tympani, are conveyed by waves of the air affuming the fhape of angles; thefe are tranfmitted to the membrane, which cover the feneftra rotunda, and this membrane being in contact with the limpid ferofity, fluctuates the vibrations, juft as it received them, on the bafis of the cochlea, where it fhakes the delicate nervous filaments fpread very thick in the membrane of the cochlea, and produces a fenfation, carried or conveyed along the portio mollis to the *grand focus of fenfe*. It happens very often, that this fenfation is carried to the teeth, when the nervous ramifications are in a ftate of inflammation, efpecially the fhrill founds. Some think that the fenfation is carried directly on the teeth, but fince I raifed founds of that kind before a deaf perfon who had bad teeth and the tooth-ach, I remain perfectly fatisfied that the contrary takes place, fince the deaf perfon did not complain of any impreffion on his teeth.—Shrill founds are carried and tranfmitted to the brain in the fame manner, but the angles of the waves of the air are acute in proportion to the fhrillnefs of the founds.

In order to conjecture as little as I poffibly could on the neceffity of the os ftapes refting on the feneftra ovalis, I contrived the following machine, and performed upon it the following experiments. I made with a bone a folid kettle-drum, nearly of the fhape of the tympanum. At the bottom of it I perforated two holes of unequal diameters to reprefent the feneftra ovalis and rotunda, and covered them with two pieces of bladder unconnected

ted with each other. I fixed at each a tube closely adapted, and covered each end with a skin as the above, and, before I placed the artificial membrana tympani, a little bony stick in form of a stirrup, was fixed on the largest hole, the upper part of the bony stick touching the inside of the artificial membrana tympani. Over this last I raised an artificial meatus, introduced an accoustick horn at the mouth of it, and raised great sounds at the large opening of the horn. During this odd experiment, I observed that the skin of the smallest tube, practised at the bottom of the artificial tympanum, did forcibly vibrate at each sound, and that the largest stood still all the time. With various kinds of musical instruments, I raised different sounds, and I remarked with equal surprise, that the result was constantly the same. I removed the bony stick from within the tympanum, and both skins vibrated at the same time. The experiments, compared with the functions of the human tympanum, indicate fairly that the os stapes rests on the fenestra ovalis to intercept or prevent the vibrations, in order that they should be only communicated to the fenestra rotunda.

OF

OF THE

EXTERNAL DISORDERS

OF THE

HUMAN EAR.

HAVING physiologically explained how the ſenſe of hearing is operated, it is now time to inveſtigate the diſorders of this organ. We meet with few caſes concerning them in our medical and chirurgical authors; whether the neglect of this branch of phyſic and ſurgery is owing to the difficulty of the ſubject, or particular neglect of our antient and modern practitioners, I will not take upon me to determine. The anatomy of the ear has made but little improvements ſince Euſtachius, Albinus, Valſava, Duverney and Haller. Its phyſiology ſeems to have embaraſſed even the moſt modern writers; and Cotunnius, who has but lately diſcovered the aqueducts of the labyrinth, has furniſhed us but with a few hints.

The ſubject has taken up my mind a long time paſt; and as I am acquainted with ſome languages, and been travelling theſe ſeveral years, I have been enabled to profit by the peruſal of ſeveral foreign publications, and attend caſes which I thought many of the medical gentlemen

tlemen did not chuse to be troubled with. It must be confessed, that a traveller is in general taken for an empiric, as many of this description appear to be so on account of inabilities to support a decent reputation; and if one is able to procure good and sound information to the medical world, there will be a great many who will hurt their fellow creatures through a lucrative profit. I have often been taken for a quack, a witch, and a conjurer, by some people; but if all these invectives have been conducive to the good of mankind, it shall be a great satisfaction to myself. Through all these difficulties, I have mustered a great many cases, which I am going to lay before the reader, yet I cannot say that I have acquired a great deal towards the removal of several kinds of deafness which afflict but too often the internal parts of the ear. I have observed, that in physic and surgery it is absolutely necessary that we should be perfectly acquainted with nature in a sound state, for which reason I have neglected nothing to make the reader conversant with her situation, design, and intentions.

The first and most external disorder of the ear, is a running of acrimonious serosity behind the ears, which happen to adults of a bad habit of body, such as scrophulous, scorbutic, *&c.* and children in general to whom it appears of service, when this natural evacuation answers the purpose of blisters, in diseases of the head. It is particularly a great nuisance to adults.

Observation. Mrs Elizabeth Bonnel applied to me in July 1777, in consequence of a continual running behind her ears; it was so copious, and of such bad smell for three years before, that she computed the evacuation to be near half a gill every day, and, to the best of her judgement, she thought it rather increased more and more. It would be needless to mention what had been tried to relieve her from such a disagreeable complaint.

By

By her account, it appeared to me, that nothing had been forgot; but, as every thing had been done without plan or aim, it is no wonder that a cure could not be obtained. When I ſaw the caſe for the firſt time, there was loſs of ſubſtance in the common teguments, and the cellulary texture; ſo that the greateſt portion of the cartillage was almoſt bare. Having reflected upon ſuch an obſtinate caſe, I formed out in my mind, that ſome principal trunk of the ſmall arteries which ramify over and under that region were deſtroyed, and that their extremities left, being of a large diameter, did bring the blood in a ſerous ſtate towards the wound or ſore part; for which reaſon, I performed large ſcarifications underneath, and dreſſed it every day with an animated diſgeſtive No. xxxv. It was left to ſuppurate with the above dreſſing for 18 days without interruption, and during the whole time the running above ſeemed to indicate an appearance of drying. The patient being extremely anxious to be cured, wiſhed I might continue the dreſſing a little longer, to have a fair trial; accordingly, I dreſſed it with the baſilicum nigrum for eight days more, and afterwards healed it with the ſimple application of a vine leaf dryed before the fire. Before the ſcarification ſhe was let blood at the arm, and took ſome purgatives No. x. which were repeated during the dreſſings, and drank nothing elſe but a decoction of the althea root. This plan operated a radical cure.

Remarks. In conſidering my prognoſtic on the above caſe, it will be aſked why the loſs of ſubſtance, after the ſcarifications, did not produce a running at that place. To that it may be anſwered, that the ramifications which ſupplied the evacuations being deſtroyed at a place where the ſkin and membrana adipoſa are ſtrong, the running was ſufficiently ſecured.

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The cancer at that part of the ear I never ſaw nor heard of, but if it has or ſhould ever take place, the extirpation of the external ear does not ſeem dangerous. Towards the latter end of February 1763, Mr John Dreux returning from the country very late at night to the city of Amſterdam, Holland, was attacked by two foot pads, who demanded his money; he made ſome reſiſtance, but was at laſt knocked down. Theſe two villains finding but little money about him, cut off both his ears and beat him moſt unmercifully. He, however, got into a neighbouring public houſe, where his ears were waſhed with cold water, and pieces of leather, covered with common ointment, were applied to the parts, till he ſhould be able to be dreſſed by a ſurgeon. To be ſhort, in ſix weeks he was cured, and ſuffered but very little in his hearing, becauſe part of the concha was left round the meatus auditorius. In order to remedy or ſupply the defect, artificial ears were made of paſteboard painted fleſh color, ſo as to imitate nature, fixed in the meatus by a ſilver tube. I have this account from Mr Dreux himſelf.

There is a diſeaſe of the external orifice of the meatus auditorius which is pretty common, I mean the occluſion of that orifice. In April 1770, a boy aged ſeven years, was brought to the Hotel-dieu of Paris. He was deaf and dumb. Monſ. Moreau, who was the principal ſurgeon of the hoſpital at that time, performed a large crucial inciſion, in the middle of the concha, through the ſkin and teguments; the os temporis being left bare, he was ſurpriſed to ſee no opening leading to the meatus, and on probing, found that the bone was uniform, and even in the whole extent of the inciſion, upon which he told one of the dreſſers to take care of it, and ſeemed to give himſelf no further trouble about the caſe. One of the ſurgeons aſked leave to try ſome method

method to practiſe an opening towards the meatus, and it being granted, the boy was removed from the hoſpital a few days after. The ſurgeon dreſſed the wound with the ſuppurative for eleven days, when, to his great aſtoniſhment, he diſcovered a ſmall orifice in the bone, beyond the anterior part of the concha. He probed it, and by degrees introduced a bigger probe, which was generally left in the orifice. At laſt he thought proper to heal the part, as no larger orifice could be obtained, and ſyringed the meatus, which was full of middling hard, blackiſh ſubſtance. A month after, the patient gave indications of hearing; and encouraged by that ſucceſs, he attempted the other ear, but the orifice of the meatus being conſiderably wider and ſtraighter, the boy was able to hear tolerably well by the help of a ſilver tube, made like a funnel, which was adapted to the meatus auditorius, for the more immediate admiſſion of the ſounds. Few years after, the boy ſpoke, heard better, and, as I have been informed ſince, ſtill continues to do ſo, if his ears are now and then ſyringed with common warm water.

I have ſeen and attended many caſes of that ſort, but none where there was not ſome kind of orifice, more or leſs open, at the outſide of the concha. When I was at Truro, in Cornwall, a young man applied to me, in conſequence of dulneſs in his hearing. I obſerved that the external orifice of the meatus auditorius did not exceed a line and a half in diameter; I probed it, and found that the internal parts were of a common length and diameter, towards the middle. I ſyringed it, and obſerved, after this operation, that his hearing was conſiderably improved by it; as the patient could not afford a ſilver tube, one of tin was provided, and he was able, by its help, to diſtinguiſh low words, but not wiſpering. Whether he has continued in that ſtate, I

cannot tell. Laſt year, a boy was brought to me with the ſame complaint; but I did not attend the caſe, for reaſons unneceſſary to mention here.

If the meatus auditorius appears ſometimes more contracted than it ought to be naturally, it is likewiſe much dilated either by diſorders or errors in nature. This laſt defect ſeems to bring on ſome others in the ſenſe of hearing; but theſe, in my opinion, are without remedy, unleſs a preventative ſhould be employed in due time; and this ſhould conſiſt in uſing ſome artificial meatus, ſo as to anſwer an exact proportion which nature ſeem to require. I have no caſe that I can relate to illuſtrate this practice, though I have obſerved the defect.

The meatus auditorius is ſubject to excreſcences, both glandular and fungous; the former is more common than the latter: beſides theſe diſorders, it has been often obſerved by many antient and modern writers, that a pellicle ariſes either by diſeaſe or naturally, in the middle of this duct; we have many inſtances of the kind, and I may ſay that I have met with it oftner than I ſhould have expected it. But before I publiſh ſuch caſes as have come to my own ſhare, I ought to mention the obſtructions of the meatus, occaſioned by the wax and extraneous bodies mixt with it.

In October 1786, a young man applied to me for dulneſs of hearing. He attributed the cauſe of that complaint to a cold, when he was on board a ſhip, or to a fever, but which he could not poſitively tell. I compared his hearing to mine with the pitch-fork, and found that the difference was about 15 ſeconds of the common pendulum; ſo that he was unable to hear words unleſs ſpoken near the ear and extremely loud. On looking into both meatus auditorius, I found them clogged to more than one-half, with hard cerumen which I extracted with precaution; and when the membrana tympani were quite cleared,

cleared, though part of the cerumen ſtill remained in the left ear, he ſaid his hearing had increaſed to a conſiderable degree. What remained of the cerumen I could not extract at that time, becauſe it was ſo hard and voluminous, that I took it for a ſtone which had increaſed with the ceruminous matter round it. I injected the meatus with No. XXIV, filled it and ſtopped the external orifice with ſome cotton dipt in the injection. Next day I attempted to extract the ſtone, but could not ſucceed, therefore dreſſed it as before; the following day it broke in two pieces, which I removed, and the meatus was then quite free.

Remarks. I have often obſerved that the cerumen, when gathered to a certain degree in the meatus, becomes ſtony or exceſſively hard. As ſeveral practitioners recommend to clear the meatus with ſoap and water, I put one of theſe ſtones in it, and the other in the injection both warm and cold, and I found that their ſolution was ſlower in ſoap water than in the injection above mentioned. Since that experiment, I never made uſe of ſoap water, tho' I think, from my own practice, it will do no harm. Similar caſes came under my care long ago, but I extracted every extraneous body without difficulty, in a quarter of an hour.

A muſical inſtrument maker, whoſe name I cannot at preſent recollect, for the benefit of further information, applied to me for hard hearing, when I was at Haverfordweſt, in Pembroke-ſhire, Wales. He was on board of a man of war, cruiſing on the American coaſts in the late war: The ſhip was wrecked on the coaſt, and being on deck at the time, he was thrown on the ſand, wherein he remained buried near a quarter of an hour. Since the accident, he never could hear at all. I looked in the meatus, and found it filled up to the very orifice. I extracted with plain warm water the extraneous

bodies that it contained, and when that was done, the man heard no better. Several days elapſed without any alteration. He called again, and complained of a prodigious ſinging in his ears. I deſired him to blow in his ears as hard as ever he could; this he repeated ſeveral times in the courſe of two days, when he came to acquaint me that his hearing was returned, but imperfectly. Buſineſs calling me ſome where elſe, I left the place, and I do not know how it turned out, but I ſuppoſe from other obſervations, that his hearing could but improve, in caſe that he continued to blow now and then in his ears.

Remarks. It is more than probable, that the meatus auditorius having been clogged for more than four years, the muſcles and oſſicula had loſt their action, and, in conſequence of that, the cavities of the labyrinth being too full of the limpid ſeroſity, the nervous ramifications in the cochlea were preſſed without injury done to the nerves, and that the oſſicula did not help the exſudation of the limpid ſeroſity through the aqueducts. When I deſired him to blow in his ears, the air forced the oſſicula to act, and of courſe the hearing returned. I have often met with caſes of deafneſs, wherein the meatus auditorius was not clogged, and cured by ſimple blowing in the ears. If ſuch a method proves of no uſe, it cannot do any harm, unleſs the breaking of the membrana tympani, if blowing ſhould be uſed with violence, the membrane being thinner than uſual.

About January 1787, a ſervant maid applied to me for a running in her ears. She was very dull in her hearing, and the matter that iſſued out of the meatus had a very offenſive ſmell. There was no excreſcence whatever; the membrana tympani was inflamed, together with the coat of the meatus, but more towards the poſterior inſide. I injected both ears with emollients. It cleaned

cleaned the meatus, and augmented the running. I mixt ſome ſpirit of wine with the injection, and ſtrengthened it by degrees. In two months time the running ſubſided, and the patient was reſtored to her hearing. A month after ſhe applied again; ſhe was dreſſed as before, and I rubbed the meatus with ſome *balſamum traumaticum* for a few days; ſhe took a purgative, and has had no return ſince, to my knowledge.

Remarks. I think that the ſeat of the running aroſe from the membrana tympani; for whenever I puſhed the injection ſomewhat harder than uſual, the blood tinged the injection, and ſhe complained of great pains in her ears. It appeared that the blood veſſels which ramify over the membrana tympani are real anteriols without correſponding veins, for they generate very faſt, and ſeem to be of the varicous kind. This idea will be ſupported by another caſe which is very common.

In June 1787, a young man, by buſineſs a wright, applied to me for a dulneſs in his left ear, and a running in the right. The matter which flowed from this ear had a very offenſive ſmell. This complaint had its origin after a ſevere fever, three years previous to the time he applied for relief. The meatus of the left ear was clogged with a great deal of ceruminous matter, which I removed cautiouſly; this duct being cleared, his hearing was conſiderably improved, and when I deſired him to blow gently in his ears, the air came through the membrana tympani. I left the ear in that ſtate, and examined the other, which offered me a conſiderable excreſcence to remove. I touched it with a ſilver probe, and obſerved it was of the glandulous kind. I ſcarified it, and deſired the patient to come next day, if it ſhould happen to be ſun-ſhine. Accordingly he came, and on looking in the left ear, I obſerved that the membrana tympani was

was closed, as the wind could not pass as before. In that state the hearing of that ear had increased. I scarified again the excrescence of the right ear; it bled profusely, and I washed it with spirit of wine and water, half and half. This I continued for a fortnight, but the running continued much the same; at last being tired of such tedious operations, I incised it towards its basis, and extracted whatever I could, but I left a good part of it behind. A week after, the remaining part disappeared of itself, and the patient was perfectly cured of the running. This ear was by far the best of the two.

Remarks. It was easy to account for the defect of hearing in the left ear, because, when the meatus is clogged with some cerumen, and the membrana tympani broke, the officula cannot perform their function; so that the dulness of hearing was more owing to the disease of the membrane, than to the cerumen on it; and it was probable that some extraneous bodies had slipt into the tympanum, since, when the ear was cleaned, there remained some dulness even when the membrana tympani had healed. But what mischief these extraneous bodies had done within the tympanum may only be guessed. The glandulous excrescence of the right ear was occasioned by an erosion of the skin which lines the meatus, and the ceruminous glands being no longer kept within bounds, they enlarged on account of the blood varicous vessels which penetrate into them. What remained of the excrescence unextirpated, contracted, after profuse bleeding in the part, and the membrane of the meatus uniting, kept the rest sufficiently secured.

In the month of June 1779, an old man applied to me for a dulness of hearing. On my examining the meatus auditorius of both ears, I found an excrescence placed at the anterior lateral inside of the meatus of the left

left ear, and another at the external orifice of the right. They were both very hard, and I miſtook them for an exoſtoſis, but on a cloſer examination, I diſcovered that they were hard fleſhy excreſcences; but as the laſt did not appear to be any obſtruction to the ſounds, I only inciſed that of the left ear, as its ſituation and ſize filled up almoſt the meatus. After its total extirpation with a pair of crooked ſciſſars, and the healing of the part, the patient received no benefit in his hearing, for which reaſon it was let alone.

Remarks. This caſe ſhows plainly, that ſounds cannot be eaſily intercepted, ſince the patient could hear perfectly well before, although the excreſcence did exiſt at the time of his hearing, and it was after a cloſer enquiry, that I attributed the cauſe of the dulneſs to the relaxation of the membrana tympani. To aſcertain my ſuſpicion, I deſired him to blow in his ears, and at that time it being ſun ſhine, kept a watchful eye on the membrana tympani, which at every blowing moved very freely upwards and downwards without any air going through it; therefore, after various uſeleſs trials to ſtrengthen the membrana, I gave up the caſe. There was a great ſinging and hiſſing noiſe in his ears, what made me conjecture that the oſſicula had loſt their action, or the malleus perhaps detached from its adheſion to the membrana tympani, or looſe within the tympanum. It would appear from this obſervation, that the relaxation of the membrana tympani, is a ſymptom of the inaction of the oſſicula or their diſlocation.

A gentleman was under my care in the month of July 1787, for a dulneſs of hearing. He attributed the complaint to ſeveral colds that he experienced for ſeveral years in attending his farm, eſpecially at night. On looking at the meatus of each ear, I obſerved but little ceruminous

ceruminous matter on the insides of the meatus, and that the membrana tympani was very dry. Both had the appearance of a dry bladder's skin, presenting several white longitudinal marks. I syringed both ears with lukewarm emollients, and for two or three days he found great benefit from them; but in time he experienced that his relief was only temporary; for which reason, I dropped a little oil of almonds in each ear, and this kept them moist for three months. Since that, his hearing returned and has continued so during two or three months with it, which he repeats whenever he thinks proper.

Remarks. This case evidently proves, that the natural state of the membrana tympani is moist and not dry, as many modern anatomists and physiologists have advanced.

About the month of July 1786, Mrs Abercrombie, who lives in Halkerston's-wynd, Edinburgh, brought me a little girl about seven years of age. I looked in the meatus auditorius of the left ear, and found it clogged with ceruminous matter, which I removed. The meatus of the right ear was obstructed with a thin pellicle, situated very near the membrana tympani, which I tore with a blunt silver probe, and afterwards cleaned the meatus as usual. After the opening of the pellicle, she could hear much better with that ear than with the other.

Remarks. I have observed that when the meatus auditorius has been clogged with a great quantity of ceruminous matter for some time, the membrana tympani becomes relaxed, and to nothing else could I attribute the defect of the left ear. When I had opened the pellicle above mentioned, I found some mucilaginous matter between it and the membrana tympani, which made me believe that she was born with it.

OF

OF THE

INTERNAL DISORDERS

OF THE

HUMAN EAR.

I HAVE thought it needleſs to mention more caſes on the external diſeaſes of the ear. Practitioners will find a variety of them which will differ very little from the above, either to inforce or object to my phyſiological principles. I am perfectly ſenſible that many external, ſimple, and complicated anomalous caſes, would produce or furniſh objections to them; but, at the ſame time, I am ſufficiently convinced, that, in general, they will hold good againſt ſome. It is now time to inveſtigate the internal diſeaſes of the ear. Many of the internals may have their original cauſe in the external diſorders, or be independent of them. For example, an abceſs on, or in the membrana tympani, may, in deſtroying this membrane, injure the tympanum and its contained parts; the membranes of the feneſtra ovalis and rotunda may be broke or deſtroyed by inflamations and ſuppurations, tho' the membrana tympani be in a ſound ſtate; the nervous ramifications of the labyrinth may loſe their ſenſibility, without, or with injury in the membrane of the cochlea, or the portio mollis in its principal

branch. All these different accidents may be properly distinguished from each other. If the nervous filaments of the cochlea are affected without any injury in the other parts, I would call this disease a *paralysis of the cochlea*; if the portio mollis be disordered with these nervous filament, I would call the disease *gutta auricula*. These different alterations in the internal part of the ear should be classed with some degree of propriety; it would enable the practitioner to distinguish every particular affection, and indicate rational means of cure. This task will be filled up by observations.

In the year, 1778 a common labouring man applied to me on account of a complete deafness on both ears, and as, from the appearance of his case, I gave him little or no encouragement, he expressed a wish to try what I should think proper, either for his benefit, or that of the public good. The reader may easily apprehend that I did not let such a fine opportunity escape, as he entertained a thorough confidence in me. The eustachian tube of both ears were perfectly pervious; the membrana tympani quite relaxed, almost transparent, and excessively thin. In such a case, the malleus might have been seen through the membrane, but I could discern nothing of it. I removed the membrana tympani of the left ear, and the tympanum being uncovered, I saw none of the officula; not even a single trace of them. The membranes of the fenestra ovalis and rotunda were open, and most of the cavities visible by the help of the rays of the sun introduced in the meatus auditorius; in short every part appeared in a dry state. The patient suffered very little from the extraction of the membrana tympani, and the blood, which amounted to about the quantity of a tea spoonful, did not run through the eustachian tube. The injection, which I threw in to wash off the blood, did not get at the mouth, but the wind, on blowing in his

his ears, came out through the meatus. A few days after, I probed the feneſtra ovalis and rotunda, but the probe, in going through the laſt, produced ſuch ſmart pains that he would not ſuffer another trial. I placed an accouſtic machine in the bottom of the meatus and ſpoke very loud; he heard the noiſe pretty well, but he could not make ſenſe of the words. I inciſed the membrana tympani of the right ear with a ſharp, long, but ſmall lancet. I left the patient in that ſtate for ſome time, and afterwards obſerved that it had reunited. I ſtopped the left ear with ſome cotton, deſired him to blow in his ears, and obſerved that the air did not get through as before. I freed the left ear from the cotton, and tried the hearing with the accouſtic machine, but as he could not hear at all, I never attempted any thing more towards the diſeaſe. I inciſed again the membrana tympani of the right ear, but crucially; and on removing the parts of the membrane inciſed, I diſcovered ſome of the oſſicula which I brought out, and on examining them with the microſcope, they proved a part of the incus and ſtapes, but exceſſively reduced in ſize. The patient and myſelf being tired by that time, the caſe was let alone for a conſiderable time. When he called for the laſt time, there was no material alteration, nor had he experienced any pains; and as our correſpondence was only by ſigns, and of courſe very much contracted, we parted.

Remarks. This caſe ſhows that the oſſicula may be diſlocated and diſunited from their adherences; and when reduced to a certain degree, evacuate through the euſtachian tube.

I have read the obſervations on deafneſs from the affections of the euſtachian tube, by Dr James Sims, publiſhed in 1787, in the firſt volume of the Memoirs of the

Medical Society of London. Page 95, he ſays, "many "uſes have been aſcribed to this *tube;* yet, I am apprehenſive, one of the principal ones has not as yet been "pointed out. From ſeveral circumſtances, I am of "opinion, that it conveys the ſound of our own voice "to the organ of hearing, in the ſame manner as the "meatus auditorius conveys to it all other ſounds "whatever; on which account, it is the principal regulator of our own voice." If the Doctor had any real knowledge of the tube and its functions, he never would have advanced ſuch an abſurdity, much leſs if he underſtood by what mechaniſm our voice takes place, and the ſound carried to the organ of hearing. In the firſt inſtance, I ought to put him in mind, that the *velum pendulum palati* is always over the euſtachian tube, when the larynx emits ſounds, and that in many caſes it is rather difficult to blow thro' it, though one might hear perfectly well,—what indicates that this tube cannot admit ſounds. In the ſecond, that deafneſs, produced by a pellicle in the meatus, could not happen, if the tube admitted ſounds. In the third, that when he will be pleaſed to ſtop cloſe his meatus auditorius, the ſounds will not be conveyed to the immediate organ of hearing, through the tube. In the fourth, that ſlow hiſſing ſounds, raiſed by the application of the extremity of our tongue near the teeth, cannot have a ſufficient force to dilate the tube, and be admitted through it, ſince forced air can hardly find its way within the tympanum. In ſhort, he was at a loſs how to diſcover whether the tube was open or ſhut, and entertained many doubts concerning the conſequence. Let the Doctor deſire his patients to blow in their ears, in ſtopping both noſe and mouth, the air going in the tympanum through the euſtachian tube will remove all doubts at once. The caſes of deafneſs he alludes to

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were certainly not an obſtruction in the tube, but a diſlocation of the oſſicula. I have cured this diſeaſe, in the year 1775, for the firſt time, when the preſent Dr Petit had taught me the method to blow through the tube. I have often obſerved that the tube may be cloſed, and the organ ſuffer nothing by it, till along time afterwards.

In the ſame work, page 114. he ſays, "The laſt method of cure which I ſhall mention is, by injections "into the tube, either from the mouth or noſe. The "injecting from the mouth ſeems rather impracticable, "—from the noſe it has, beyond a doubt, ſometimes "ſucceeded; and whoever would wiſh to know more "of this method, may conſult Mr Wathen's very inge-"nious paper on the ſubject, in the 49th volume "of the Philoſophical Tranſactions." I have no patience with people who publiſh ſuch nonſenſical quotations. It appears plain, that the aim of that paragraph is either ironical or juſtifies a common ſaying: *C'eſt un barbier qui raſe un autre.* But, as I think proper to recommend this work to the medical world, I find myſelf indiſpenſably obliged to refute the above abſurdity. In a work intitled "*Traité des Inſtrumens de Chirurgie, par Monſieur Garengeot,*" we find the deſcription of the inſtrument to inject from the mouth, through the euſtachian tube, with an obſervation of a gentleman who injected himſelf; but the complaint he was cured by it, was, in my opinion a diſlocation of the oſſicula, which could not be reduced by blowing in the ear. I have the inſtrument, and I make a frequent uſe of it; but I only place it, and the patient injects himſelf; becauſe I have found by experience, that the water pouring towards the throat, was better managed by the patient than by me. In placing the end of the inſtrument in the orifice of the euſtachian tube, I carefully convey it cloſe and behind the upper part of the *uvula*, and endeavour to hook with it

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the velum pendulum palati to bring it forward; and when I am ſure, by groping, that the inſtrument is in the opening of the tube, I puſh it in a little externally; this done, I give the whole into the hands of the patient who puſhes the injection, his head low, and facing the ground. Let the Doctor and Mr Wathen introduce the extremity of a long and crooked hollow probe at the end of a ſyringe, through their noſtrils, up to the euſtachian tube; they ſhall ſoon find, that pains, ſneezing, and ſnuffling, muſt baffle their attempt. I am morally certain, that if ſuch a gropping and injecting has ever been practiſed through the noſe, it muſt undoubtedly have been tried on a dead body; for as to the living, I am phyſically certain of the impoſſibility of it, or the perſon was ſenſeleſs. This practice brings into my recollection a ſaying of Monſieur Moreau, who was without doubt the firſt practical ſurgeon in Paris. Let ſurgeons perform four hundred operations upon the dead body, it will not be equivalent to the fourth part of a ſingle operation on the living. I really think that many writers ſhould behave more cautiouſly, both in praiſes and recommendations.

In February 1784, a young woman applied to me for relief in her deafneſs. She had been troubled with a continual ear-ach for two months together; her menſes had never appeared but once, and that two years before the diſorder took place. By her account, the pains were periodical. When I firſt ſaw her, there was a tenſion and ſwelling at the membrana tympani, attended with inflammation. She complained of a hiſſing noiſe in her head, and violent pains in her ears. She was bled at the arm, loſt thirty-two ounces of blood in three days, and took ſome purgatives, which operated powerfully. Six days after, ſhe took, for the firſt time, 25 drops of laudanum in two ounces of water at bed time.

The

The ſecond night 26 drops in the ſame quantity of water; and the doſe was increaſed of one drop more every night, till it amounted to 46, when her hearing returned in ſome degree. She was deſired to blow in her ears ſeveral times a day; and, in the courſe of a month, ſhe became able to diſtinguiſh words of uſual converſation. Being pleaſed with that degree of hearing, I diſcontinued my attendance.

Remarks. The above caſe was not occaſioned by the occluſion of the euſtachian tube, becauſe, from the begining, the air could paſs from the mouth into the tympanum. It was neither a diſlocation of the officula, nor the relaxation of the membrana tympani, ſince the hiſſing noiſe was about the upper part of the temporal region: But an inflammation of the containing and contained parts of the tympanum, and likely a dilatation of the aqueducts, which poured in the cranium more limpid ſeroſity than could be abſorbed; and the inflammation of the membrana tympani, together with the above ſymptoms, were ſufficient ground for my conjecture.

A gentleman was under my care in the year 1778 for a ſimilar complaint. He had been deaf one year and a half, and had applied various watery and oily fluids at different times, in the meatus auditorius, without any ſenſible benefit. The ſymptoms were very much like thoſe of the above caſe, except that the hiſſing noiſe, inſtead of being in the head, was in the labyrinth. I treated him upon the ſame plan as the above caſe, but he did not obtain a cure.

Remarks. I am pretty certain that the complaint had its origin in the labyrinth, and from compariſon with many caſes, it occurred to me that it was a paralyſis of the nervous filaments, and an obſtruction or occluſion of the

the aqueducts of the labyrinth, as the deafneſs came on by degrees. I had occaſion to ſee him three years ago, labouring under a complete deafneſs, which I think was the *gutta auricula*.

I recollect having read in a German book, intituled, " *Remarks on anomalous diſorders*," the following paragraph: " One of my acquaintance ſleeping in the " open field, was ſuddenly awoke by a great ſnap or " noiſe in his right ear; he immediately ſtarted up, " and felt ſome inſect groping in his ear, ſhook " his head, in order to get rid of it, but perceiv- " ed nothing. He felt no pain except tickling, which " ended as ſoon as he had ſhook his head. On inſpect- " ing the membrane of the drum, I obſerved a large " opening, which ſeemed to have been made by what " is vulgarly called an *ear-borer*, a well known " inſect. The air came out from the throat very free- " ly, if the noſe and mouth were cloſed, ſo that I real- " ly think he might have breathed that way; there was " at the time no pains whatever, and the loſs of hearing " came on by degrees, without any other inconvenience," *&c. &c.* The above caſe, together with many others coincide in proving that the membrana tympani is of great uſe to preſerve the inſide of the tympanum, and the mechaniſm, or functions of the oſſicula in the ear.

In the month of July 1783, when I travelled through the weſt of England, I had many opportunities of being conſulted for children who were born deaf and dumb, as I cured two children who were afflicted with that complaint. Among thoſe who came to me for relief, there was a girl aged about ſeven years, who had no tympanum, and, I firmly believe, that no accident had happened from the appearance of the meatus auditorius. The cavities of the tympanum were all ſmooth and uniformly covered with the common perioſteum. I could diſtinguiſh the

the trace of the fenestra rotunda and ovalis; but, as the child would not allow me to probe, I could get no further information.

About the beginning of October 1786, a young boy, born deaf and dumb, was brought to me. The meatus auditorius of both ears, and the concha in particular, were so soft, that it was no difficult matter to apprehend a deficiency of some of the cartillaginous parts. It appeared, that most part of the meatus was improperly ossified, and the membrana tympani thicker than common. I removed from each meatus a great quantity of ceruminous matter and thick pellicles, which were adherent to the membrana tympani. After these operations, the boy gave indications of hearing, and I left the case alone to take its chance, perceiving no further defect in the organs. Sometime after I met with the mother, who informed me, that the boy attempted to speak with his father and sister; with the latter, he used to speak a particular language which is incomprehensible to every body but themselves. They are both very young, so that it is rather difficult to determine whether the boy's hearing be perfect or not; but, it is evident, that if the membrane was reduced to a thinner state than it is at present, I make no doubt that the boy would receive great benefit from it.

Remarks. This case, which was not new to me, shows that practitioners should pay particular attention to the state of the membrana tympani, because its strength occasions the same defect as its thinness. I wished to proceed further in the case, but interested considerations were an obstacle; and, I must acknowledge, that in tedious cases, patients think that we want to take advantage of them, consequently, it is proper sometimes to stop.

In August 1786, a young man applied to me for a great dulneſs of hearing. He was formerly a ſervant, which ſituation he could no longer fulfil on account of his complaint. The diſorder took place after a cold, or a fever, but as both afflicted him at once, he could not be ſure to which it might be attributed. He had aſked advice, and what had been done proving of no ſervice, the diſeaſe was left to take its chance for two years, before he applied to me. When I looked in the meatus auditorius of each ear, I found very little ceruminous matter, the membrana tympani was very white, and covered with a mucuous ſubſtance. I ſcraped the membrana tympani with a ſlender ſilver probe, ſhaped at one end like a ſhovel; it bled, and became extremely painful, but a few days after, every ſymptom ſubſided, and the hearing improved. He had blown in his ears very often, and one day that he did it ſtronger than uſual, he heard a great ſnap within the right ear; and, in a little time after, his hearing became perfect. The blowing hard being recommended, produced the ſame effect in the left ear about a fortnight after, when all things conſidered, my attendance was no longer required.

Remarks. It appears that the above caſe was a complicated one, but whether it was to the diſlocation of the oſſicula, or to the thickneſs of the membrana tympani, dependent or independent of each other, that the complaint took place, I ſhall not take upon me to aſcertain; however, I am almoſt ſure that the membrana tympani, in that ſtate, was ſufficient to occaſion dulneſs, as well as the diſlocation of the oſſicula.

I had under my care, very lately, three young women at the ſame time, who were afflicted with periodical deafneſs. All three were alſo labouring under violent inflammations in their eyes. One of them, the daughter

of

of John Johnſtone, a farmer near Borrowſtowneſs, was quite blind; the other, the daughter of a miller near Dalkeith, was perfectly blind of the left eye; as to the third, the ſymptoms were not ſo aggravated, having had better attendance than the other two. The firſt patient was bled ſeveral times for the above complaints, and, on account of her menſes, which had never appeared. I cured her eyes in the courſe of a month, and, when I diſmiſſed her, ſhe was not able to hear the report of a gun. It not being convenient for the family to ſtay any longer in town, I cleaned both ears, and deſired her to blow in them every now and then. Since that time, ſix months have elapſed, I have heard that ſhe had recovered her hearing. The other two patients came to their hearing by the ſame means; their menſes appeared, and have continued every month ſince the firſt bleeding. When the menſes have never run, I always bleed in the full moon; whether it is prejudicial, or grounded on reaſon, I will not take upon me to determine.

Remarks. I am firmly of opinion, that theſe caſes of deafneſs are occaſioned by plenitude of blood in the lymphatic arteries, which ramificate within the cavities of the labyrinth, or an inflamation of the parts contained in the tympanum, which preclude the oſſicula to perform their functions. The ſymptoms are generally an inflammation of the membrana tympani and its environs, the inflammation of the eyes, and a great hiſſing noiſe within the ears.

In July 1786, two boys, born deaf and dumb, were brought to me by their mother from the county of Fife, who informed me that ſhe had two more at home in the ſame ſituation, but on account of their youth, ſhe did not think proper to take them along with her.

 The

The oldeſt was about thirteen years of age. He had in each ear a thick pellicle almoſt cloſe to the membrana tympani, that I extracted; the loſs of blood did not exceed a tea ſpoonful, and, in the courſe of a week, he gave indications of imperfect hearing. The other was eight years old; the membrana tympani was exceſſively thick. I attempted to make it thinner by the ſame means indicated in one of the caſes above mentioned. During the operation, I had occaſion to uſe a ſharp pointed ſteel inſtrument, and, as it was cloſe to the membrane, the boy happening to cough unexpectedly, the inſtrument went through the membrana tympani, and being conſcious of the conſequence, proceeded no further. The other ear offered neither difficulty in the ſame operation, nor accident of the kind. Some days after, I looked at the wounded membrana tympani, that had been accidentally inciſed, and found it perfectly cloſed.—This boy did not appear to hear as well as the other, but on account of being unable to get information from children in their ſituation, I deſired the mother to go home, and bring them back again two or three months after. Accordingly ſhe did ſo, and informed me, that ſhe was perfectly ſure they did hear the ſinging of pſalms at church time, but they had not yet attempted to ſpeak, except unintelligible ſounds. I really think that theſe children being always kept together, and uſed to converſe by ſigns that nobody underſtand but themſelves, it is difficult to judge whether they are, in their preſent ſituation, enabled to ſpeak, or if it be owing to any defect in their organ of ſpeech. I have attended many of theſe caſes, and found in general that they become able to ſpeak a ſort of language in the ſpace of about two years after. The mother brought me a little girl about four years old, and on looking in the meatus of each ear, I found but a looſe thin pellicle on each

each membrana tympani, that I extracted; but the child is so young, and so little time has elapsed, that I cannot form a just idea of these three cases. All I am able to say of them at present is, that I presume there is little or no articulation of the officula in the two boys ears, and the girl a defect in the organ of speech, because she utters different sounds than the others do, and upon the whole seems to hear better.

Remarks. The membrana tympani were excessively tense and thick in the three above cases, and as I suspected, the eustachian tube closed, (because I never was able to make them blow in their ears,) I put a hollow tube on the membrane, and sucked up the air, in order to reduce the officula in case of a dislocation, but whether it answered I could not guess. I tried the injection of the tube by the mouth, but the boys opposed every artful means employed to bring it about; so that the reader may well imagine what trouble, time, difficulty, and patience such cases require, considering such obstacles to put in practice every necessary method. Upon the whole, the eldest was able to obey my commands by sounds; he knew the motions of my lips, for which reason I placed my self behind his back. I was well aware of the method to convey uniform ideas by a regular practice of uttering the very same sounds, for, whenever I deviated in the least, tho' he heard, he was in suspence whether he should execute my orders, which were to raise from his seat at the loud sound of A, and to sit down at that of O. All these hints indicate how hard it is to learn the distinction of sounds, and acquire ideas uniform to their meaning, in supposing their organs fit for the purpose. I am almost convinced from the knowledge of every circumstance relating to these children, that if they were separated from each other for a while, they would be able to

speak

ſpeak in a ſhort time; but it has not been convenient for the family to do it.

A young woman has been under my care for a conſiderable time on account of deafneſs. Previous to her application to me, ſhe had laboured under the complaint about eight or nine years; and, ſhe informed me, it came on by degrees after a violent fever. The meatus auditorius of the left ear contained little or no cerumi-nousmatter, and what there was of it had a whitiſh look; the membrana tympani of that ear was ruptured, but, on account of the depth and crookedneſs of the meatus with a narrow diameter, I could not diſtinguiſh how the tympanum ſtood. The meatus auditorius and membrana tympani of the right ear were wider, and the membrane very much relaxed; the euſtachian tubes were open, becauſe, on blowing in her ears, the air from the throat came through the ear. In that ſtate, ſhe could hear the ſound of a pitch-fork when applied to her teeth or the upper part of her head; ſhe could alſo hear any tune played on the violin, if the head of the inſtrument touched her teeth, or any part of her head. With the right ear, ſhe was even able to hear, when the mouth of the ſpeaker was cloſe to that ear, but exceſſively loud. I tried various methods to render the membrana tympani more tenſe, and to reduce the diſlocation of the oſſicula, in caſe it ſhould have been the caſe, but all my efforts were of no uſe. She complained at firſt of a hiſſing noiſe in both ears, but it ſubſided by the forced injections and other methods then uſed; at laſt, I gave the caſe up, and ſhe is ſtill to my knowledge in the ſame ſituation, without any alteration whatever.

Remarks. It would appear by the above caſe, that there was a complication of more diſorders than the ſituation of the parts would admit to inveſtigate on a clear

principle,

principle. I have often lamented, that, with the practice which has fallen to my ſhare, I never was able to aſcertain the ſymptoms of the *gutta auricula*, which I take to be an affection of the *nervi auditorii*. Sometime before, a gentleman applied to me in conſequence of a ſimilar caſe, but the membrana tympani being ſtretched, the euſtachian tubes open, and his organs deprived of hearing, I took the caſe for the *gutta auricula*, conſidering every circumſtance together.

I communicate to the medical world this Treatiſe on the Ear, in order that ſome more light may be thrown upon a ſubject ſo intricate, and too long neglected. The reader will pleaſe to recollect, that the *gutta ſerena* and *gutta auricula* are common caſes, and very little underſtood; the ſymptoms of the firſt may be aſcertained by obſervations and informations from the patient, whereas the laſt may be only gueſſed with great difficulty and doubts. I have advanced in ſeveral places, that I have often cured the *gutta ſerena*, and in others ſaid that it is incurable. This contradiction does not ariſe from my miſtake for in the caſe that I read at the Royal Academy of Surgery at Paris, (quoted p. 202). I prove, that the caſe was miſtaken for ſuch, which made me mention it in that light, as well as the others. I have been ſucceſsful in diſorders of this kind, and yet I muſt freely acknowledge, that it has been without the uſe of electricity, which I reject in diſeaſes of the Human Eye and Ear as uſeleſs. It would, perhaps, be to the honour of the medical world in general, if entirely laid aſide.

Before diſmiſſing theſe two Treatiſes, I ought, as a man of feeling, to open my mind more freely than I have on medical electricity, in addition to what I ſaid before. If one had the preſumption to aſk the promoters of it, what they expect from that ſtimulant fire, this would be undoubtedly

undoubtedly the anſwer: "We know the great and "wonderful atchievements of the *Roſy Goddeſs* of *Health* "when in the Adelphi, and at the *Hymen Temple*, Pall-"mall, London; her travels through different parts of "Great Britain. Who knows, if ſhe has not viſited the "Moon, and made her appearance again here under the "diſguiſe of a tall-man cloathed in white, or ſome "other odd dreſs! ſtrenuouſly recommending ſweet ef-"fluvia, electrical, celeſtial fire, *&c. &c.* earthen or ſand "baths, water drinking, and plenty of air, or other "ſtrange *recipe;* curing ſuch diſorders as other medical "men cannot manage or palliate. We are told by "Doctors Cavallo, and Katterfelto aſſiſted by his black "cat, that they cure every diſeaſe by electricity, of "courſe we are anxious to tread upon their ſteps, altho' "we have no great opinion of either, by our own un-"ſucceſsful imitations."

Who has been cured by electricity? Thoſe patients who were aſſiſted by nature. What are theſe curative obſervations of medical electricity, recorded by its promoters? Mere tales. What people recommend for medical purpoſes this well known fire? Enthuſiaſts, intereſted men, Quacks, *&c. &c.* The ſame might alſo be ſaid of ſea-bathing, adviſed by phyſicians and ſurgeons, when they are *ſur le banc des ignorants*, or willing to get rid of their patients in a genteel manner.

I once paid a viſit to Dr Gray in the Britiſh Muſeum of London, accompanied with Mr John Sheldon, Profeſſor of Anatomy, who was then labouring under a diffuſion in his knees, on purpoſe of being electrified for it. The Doctor ſhowed us his electrical apparatus, which is the moſt complete I ever ſaw. Two electrometers of his invention produced the moſt ſurpriſing effects. He was at that time electrifying a young man who was afflicted with a ſlight ophthalmia. The cornea was extremely

tremely tarnifhed, on account of fome varicous veffels whofe extremities ramified externally over the cornea. The Doctor was electrifying the eye by gentle ftreams, and, having darkened the room, fhowed them to us, ftriking on a receiver, confpicuoufly feen behind the head. In fhort, they had a beautiful appearance, many of them reflecting the prifmatic colours admirably well. This patient had been under his care for a confiderable time for the complaint; and, upon my telling him that fuch a difeafe might be removed in three days, with the ufe of No. XXXI. applied every other day under the lids for three times only, he feemed furprifed. Indeed, I believe, I convinced him that nature operated more than the electrical fire, which I looked upon as an ineffectual ftimulus to deftroy the varicous veffels.

In the firft edition of my Treatife on the Human Eye, I was blamed by fome, for publifhing the *formulæ medicamentorum*; but the number of thofe who approve of them, being more numerous, I will run the rifk of difpleafing the firft, to oblige the fecond, reflecting that it is more eafy to pafs them over than be wanting. I know likewife by experience that many practitioners have made ufe of them without fuccefs in cafes indicated for their ufe, where I have effected a cure with the fame on the fame patient; confequently, it was not the fault of the *recipe*, but the improper method to employ and conduct it, or the defect of its ingredients.

FORMULÆ MEDICAMENTORUM.

No. I.

PTISANA COMMUNIS.

R.	Radic. Gramin. mundatar. contuſ. & inciſ.	℥ iv.
	Coq. in Aq. comm.	℔. xij.
	Ad.	℔. x.
	Infund. Glycyrrh. raſ. & contuſ.	℥ j.
	F. S. A. Ptiſana.	

This diluent is of ſuch a nature, that it opens the pores by the means of its ſharp particles, attenuates thick and viſcous humors, either in blood or lymphatic arteries; inſomuch, that they eaſily circulate through them, after the uſe of it. Its doſe, for a common conſtitution, is two quarts *per* day, drank every other hour by a gill; but, in order the patient be able to digeſt well his meals, let two hours diſtance before and after them.

No. II.

No. II.

PTISANA SEU AQUA HORDEI.

R.	Hordei confr. & loti.	℥ iv.
	Coq. ad tertiæ partis consumpt. in Aq. comm.	℔. xij.
	Infund. Glycyrrh. raſ. & contuſ.	℥ j.
	Cola & F. Ptiſ.	

This diluent cleanſes the body from viſcous humors. It is more deterſive than the foregoing; its doſe and manner of drinking is juſt the ſame as the above; beſides, it is exceeding good for the affections in the thorax.

No. III.

PTISANA SEU AQUA ORISÆ.

R.	Oriſæ mund. & lotæ.	℥ ij.
	Bull. per ſemi hor. in Aq. comm.	℔. xvj.
	Adde, ſi lubet, Raſur. C. C. in nodulo incluſ.	℥ j ſs.
	Vel ex præſcripto Rad. Conſolid. major.	℥ iij.
	F. Ptiſ.	

This diluent, for common drink, as the above. It is very uſeful in hemorrhagiæ and diſenteric affections.

No. IV.

No. IV.

PTISANA LAPATHI.

R. Rad. Lapathi acuti mundat. & incis. ℥ iv.
Coq. ad tertiæ partis consumpt. in Aq. comm. ℔. xij.
Infund. Glycyrrh. ras. & contus. ℥ j.
F. Ptis.

This diluent is of a great benefit for removing the jaundice and obstructions in the liver. Its dose is a quart *per* day, drank at equal times.

No. V.

PTISANA LAXANS SEU REGIA.

R. Rad. Lapathi acut. ℥ j ʃs.
Polyp. Quern.
Chichor. Sylvestr. ana ℥ j.
Fol. Orient. mund. ʒ vj.
Sal. Cathart. amar. ℥ j.
Bull. in Aq. comm. ℔. iv. ad ℔. iij.
Sub finem Adde Anisi, ʒ j.
Liquir. ras. & contus. ʒ iij.
Malum Citreum in talleol. sect. No. i.
Colet. Liquor.

This diluent is a gentle purgative, very effective and convenient. Its dose is three gills, each to be taken in a morning at half an hour distance from one another, after which the patient may drink and eat moderately at his meals as usual.

No. VI.

No. VI.

DECOCTUM CEPHALICUM.

℞.	Herb. Meliſſ.	
	Beton. ana	M. iv.
	Summit. Florid. Galli luteii,	
	Stæchad. ana	M. ij.
	Coq. leviter in Aq. comm. S. Q. ad	℔. xij.

This decoction is very effective for removing head-achs and numbneſſes of the ſenſes; it fortifies the nerves and refreſhes the animal ſpirit. Its doſe is four gills *per* day, at proper and equal intervals.

No. VII.

DECOCTUM DIURETICUM.

℞.	Rad. Bruſc.	
	Aſparag.	
	Rubiæ Tinct. ana	℥ iv.
	Fol. Pariet.	
	Chritmi,	
	Herniar.	
	Raphan.	
	Summit. Lupul. ana	M. ij.
	Coq. in Aq. comm.	℔. xvi. ad xij.

This decoction is attenuating, incifive, and works powerfully by the urine, eſpecially when the reins and bladder

bladder are lined with gluish humors. It is also made use of with success in several kinds of hydropsies, to carry off the thinner part of the mass of the blood through the urine. Its dose is six gills *per* day, taken separately, as circumstance requires it.

No. VIII.

DECOCTUM OPHTHALMICUM.

R. Fol. Euphras.	
Plantag.	
Fænicul. ana.	M. iv.
Chelid. maj.	M. ij.
Flor. Rosar.	
Cyani, ana.	*Pug.* iv.
Coq. in Aq. comm.	℔. xv. ad. xij.

This decoction is made use of with success in the inflammation of the eye-lids and conjunctiva. The use of it is to wet softly the outward parts of the globe of the eye, when covered with its eye-lids, with a small hair pencil dipt in the decoction. But I shall observe here, that the patient ought to keep his eyes shut till the eye-lids be quite dry of themselves, in order the lotion may infiltrate through the pores of the skin. This lotion may be made use of as often as the case requires it, without any bad consequences.

No. IX.

No. IX.

DECOCTUM CASSIÆ.

R.	Siliq. Ægyptiacar. confract.	℔. *ss.*
	Coq. in Aq. comm. vel seri Lactis Q. S. ad	℥ xij.
	Colat. Solv. ex Præscript. vel Tart.	
	Solub. vel Salis Polychr. Rupell	ʒ ij.

This decoction softens and opens the belly in a gentle manner. Its use, continued for several days together, removes costiveness. The patient divides the above dose in two potions, and drinks them in a morning at one hour distance; he may even divide it into three, if he likes it better, always keeping a due regulation of time.

No. X.

DECOCTUM SENNÆ.

R.	Fol. Senn. mund.	℥ *ss.*
	Salis Veget. vel Sal. Rupell.	ʒ ij.
	Bull. leviter in Aq. comm. S. Q. ad	℥ xij.
	Infund. Semin. Anisi,	
	Fœnicul. ana	*Pug.* j.
	Liquirit. cont.	ʒ ij.
	Colet liq.	

This decoction is a strong and powerful evacuative for carrying off all kinds of humors. The dose of this prescription ought to be divided into two potions, and drunk in a morning at two hours distance from each other.

No. XI.

No. XI.

POTIO CATHARTICA EMOLLIENS.

R.	Decoct. Cassiæ,	℥ vj.
	Solv. Mann.	℥ ij.
	Sal. Vegetab.	ʒ j.
	vel Salis Chathart. amar. vel Polychrest. Solub.	ʒ ij.
	Addi potest, ex Præscript. Syrup. de Cichor. compos. vel de Pomis vel de Rosis Solut. ℥ j. vel Q. S.	

This potion is purgative, and carries away the foul humors in a gentle manner, if the patient has been prepared to it by the use of some diluent drink. It ought to be preferred as a first purgation in acute and inflammatory disorders. The whole may be taken at one time.

No. XII.

POTIO HYDRAGOGA.

R.	Decoct. Senn.	℥ vi.
	Solv. Mann.	℥ j ſs.
	Colat. Adde Pulv. Jalapp. vel Cornachin.	℈ ſs.
	Dilue Syrup. de Rhamno Cathartic.	℥ j.

This potion evacuates powerfully the serosities. It ought chiefly to be made use of in hydropsical cases, and œdematous affections. This dose may be taken at one time as the above.

No. XIII.

PULVIS STERNUTATORIUS.

R.	Radic. Ireos,	ℨ j.
	Fol. Majoranæ ſicc.	
	Florum Lilii convall. ana.	ℨ ſs.
	Helleb. alb.	℈ j.
	F. Pulv.	

This ſternutatory powder is very beneficial for removing habitual and inveterate head-achs, apoplexy, and ſoporous affections; it produces frequent ſneezing, and ſometimes a bleeding at the noſe, what very often relieves the patient from theſe complaints. Its doſe is one pinch, taken by the noſe, the repetition of which depends on the ſtrength of the patient, and the effect of the ſternutatory.

No. XIV.

COLLYRIUM TEMPERANS.

R.	Aq. ſtillat. Sperniol.	
	Solani, ana	℥ iij.
	Trochiſc. alb. Rhaſis,	ℨ j.
	Sacchar Saturni,	Gr. x.
	M. F. Collyrium.	

This collyrium is generally made uſe of for the inflammation in the eye-lids. Its uſe is to wet them with a ſoft rag dipt in it, three times a-day, as long as the inflammation ſubſiſts.

No. XV.

No. XV.

COLLYRIUM IN VARIOLIS.

R.	Aq. ſtillat. Roſar.	
	Plantag. ana	℥ iij.
	Croci pulver.	*Gr.* xv.
	M. F. Collyr.	

This collyrium is of very great ſervice when the eyes are too watery, as it aſſuages the acrimonious humors, which, in this ſtate, bath continually the exterior parts of the globe. Its uſe as the above.

No. XVI.

COLLYRIUM RESOLVENS.

R.	Decoct. vel Aq. ſtillat. Ophthalm.	℥ vj.
	Ireos pulv.	℈ j.
	Caphuræ,	
	Croci pulver. ana	*Gr.* viij.
	Spirit. Vini,	ʒ j.
	Sacchar. Candi,	℈ j.
	M. F. Collyr.	

This collyrium ought to be particularly made uſe of when the ophthalmia come from the obſtruction in the ciliary glands, as it is very ſucceſsful in theſe caſes. If the globe of the eye be not affected, ſome very fine compreſſes, lightly wet in it, may be applied over the eye-lids, and fixed up with as little compreſſion as poſſible.

No. XVII.

COLLYRIUM ASTRINGENS.

℞.	Aq. ſtillat. Roſar. rubr.	
	Plantag. ana	℥ vj.
	Tuthiæ præparat.	ʒ j.
	Vitriol. alb.	Gr. x.
	Alumin.	Gr. vj.
	Miſce.	

This collyrium ſtrengthens the membranes which make up the outward parts of the eye. It is uſed as the above.

No. XVIII.

COLLYRIUM VULNERARIUM.

℞.	Decoct. vel Aq. ſtillat. Ophthalm.	℥ vj.
	Radicis Ariſtoloch.	
	Ireos pulver. ana	℈ j.
	Elixir Propriet.	Gutt. xv.
	Aq. Vulnerariæ,	ʒ j.
	Miſce.	

This collyrium is uſed as the above; its propriety is to diſpel inflammations when produced by extraneous bodies, wounds, or contuſions in the eye.

No. XIX.

No. XIX.

COLLYRIUM IN INFLAMMATIONIBUS.

℞. Vitriol. alb. ʒ j.
Camphor. ℈ ſs.
Ireos Florent. ℈ j.
Inde in Ovi Albumine indurato, ex quo prius Vitellus exempt. fuerit. Macera, per 4 hor. in Aq. Plantag.
Roſar. ana ℥ vj.
Contere Totum ad totius Solutionem, & Cola.

The habitual inflammations, and what the vulgar call continual red eyes, can only be removed but by the re-eſtabliſhment of the tone in the blood veſſels which ramificate the conjunctiva over the globe, and ſpread by degrees over the cornea, nay, on the internal ſurfaces of the eye-lids; therefore, as this liquid has a propriety of cooling with that of deterging, it is recommended in ſuch caſes.

No. XX.

ENEMA SIMPLEX.

℞. Aq. comm. vel Decoct. Furfuris, vel Semin. Lini Q. S.
Fiat Enema.

This clyſter ought generally to be given in the beginning of any chronical diſorders, to facilitate the evacuation

ation of the excrements in the *primæ viæ*, when patients are coſtive; beſides this, it is alſo uſeful to cool the humors during the courſe of the diſorder.

No. XXI.

ENEMA EMOLLIENS.

℞. Decoct. Emollient. Q. S.
Adde Olei Olivar. ℥ iij.
F. Enema.
Cum doloribus excruciantur Inteſtina, aut Inflammatione laborant abdominis Viſcera Enematis Emollientibus demulcentur.

Decoct. vero Emolliens fit ex fol. Malvæ, Alteæ, Betæ, Violar. Mercurial. Senecion. ana Q. S.

No. XXII.

ENEMA EMOLLIENS LAXANS.

R. Decoct. Emoll. Q. S.
Dilue, ex Præſcrip. vel Mell. Mercurial. vel Nympheæ, vel Violar. ad ℥ iv.
vel Electuar. Lenitivi, ℥ j.
vel Pulpæ Caſſiæ, ad ℥ ij.
vel Siliquar. Ægyptiacar cum Nucl. confract. ad ℥ viij.
Fiat Enema.

This medicine injected into the bowels by the fundament, is of great help to a ſlow purgative, or very recommendable to diſpoſe patients for copious evacuations, when other methods fail.

No. XXIII.

No. XXIII.

INJECTIO VULNERARIA.

℞. Decoct. Herbar. Traumatic. comm. ℔. j.
Mellis Rosat. ℥ ij.
M. F. Inject.

This injection is made use of to clean deep and fistulous wounds; it deterges also the saccus lacrymalis, and re-establishes it to its natural state. It may be injected, either luke-warm, or cold, through the puncta lacrymalia, or the inferior orifice of the ductus ad nasum; but it operates more powerfully, when employed warm.

No. XXIV.

INJECTIO VULNERARIA COMPOSITA.

℞. Radic. Ireos Florent.
Aristoloch.
Gentian. ana. ℥ i ʃs.
Coq. in Aq. comm. ℔. viij. ad. ℔. vj.
Adde Summit. Hyperic.
Absinth.
Centaur. min.
Fol. Agrimon.
Scordii,
Hederæ terrestr. ana. M. j.
Coq. iterum ad ℔. v.
Colaturæ singulis ℔. Adde, ex Præscripto, Vini alb. vel Spirit. Vin. vel Aq. Vulnerariæ, vel Tinctur Myrrhæ aut Aloes
Q. Conven.
F. Inject.

This

This injection is made use of as the above, and in the same cases; but it is a great deal more detersive, and resists to the putrefactive humors till it carries them off along with it.

No. XXV.

INJECTIO ASTRINGENS.

R. Decoct. vel Aq. still. Astringent. vel Aq. Plantag. ℔. j.
Mellis Rosac ℥ ij.
Lapid. Medicamentosi; ʒ ſs.
Misce.

This injection is detersive; its use as above. It is also recommended as a lotion when the saccus lacrymalis is so far disordered as to be fistulous in the cellulary texture.

No. XXVI.

FOTUS AD ERYSIPELAS.

R. Fol. & Flor. Sambuc M. v.
Coq. ad tertiæ partis consumpt. in Aq. comm. ℔. v.
Colat Add. ex Præscript. Aq. Vitæ, vel Spiritus Vini Camphor. Q. Conv.

This fomentation is of great benefit for removing the erysipelatous disorders. Its use consists by wetting the parts several times a day; and in case it cannot be practised, a fumigation of the same fluid ought to take place,

place, as it does not ſo much excoriate the epidermis. This operation of fumigating requires that the fluid ſhould be boiling hot, and that the patient ſhould expoſe the diſordered parts over the ſteam, till a ſufficient infiltration be operated, to dilate the parts as the caſe require.

No. XXVII.

CATAPLASMA EMOLLIENS.

℞. Radic. Lilior. albor.
Alth. ana ℥ ij.
Fol. Malvæ,
Altheæ,
Acanthi,
Senecion. ana M. j.
Flor. Verbaſc.
Chamæmel.
Melilot. ana *Pug.* iij.
Coq. in Aq. comm. S. Q. ad Putrilaginem. Magna Contunde, & per ſetaceum Trajice.

This cataplaſm ſoftens the tumors which ariſe from inflammations; they muſt be applied as warm as poſſible. But I will obſerve here, that in caſe the globe be inflamed, the emollient fumigation is preferable, as it anſwers both ways without any bad conſequence.

No. XXVIII.

CATAPLASMA RESOLVENS.

R. Fol. Alth.
Perſicar. urentis,
Parietariæ,
Scordii,
Abſinth. ana M. j.
Flor. Chamæm.
Melilot,
Sambuc. ana *Pug*. iij.
Semin. Carvi,
Anethi,
Fœnu græci. ana ℥ j.
Cumini, ℥ ſs.
Bulliant, ad Putrilaginem, in Oxymell.
Pulpæ trajectæ adde Farin. Orob.
Fabar. ana ℥ ij.
Coq. cum Decocto ejuſd. Cataplaſmat. ad debitam conſiſtentiam.
Adde Camphoræ in Spirit. Vini Solut. ʒ j.
Fiat S. Art. Cataplaſma.

This cataplaſm is made uſe of in caſe of cold tumors; its activity divides, attenuates, and diſſolves, very powerfully, the thick and gluiſh humors which occaſion thoſe kinds of tumors.

No. XXIX.

CATAPLASMA EX QUATUOR FARINIS.

R. Quator Farin. Reſolvent. ℔. j.
Coq. ad debitam Conſiſtentiam in Vini S. Q.

This

This cataplaſm is not ſo active as the above; its propriety is to re-eſtabliſh the motion of the eye-lids when ſuſpended. Its uſe as the former.

No. XXX.

FOTUS AD ERYSIPELAS.

R. Flor. Sambuc.	
Chamæmel.	
Melilot. ana	*Pug.* j.
Infunde in Aq. bull.	℔. j.
In Colatur. Diſſolve Sapon. alb.	ʒ ij.
Adde Spirit. Vin.	℥ ij.

This fomentation is warmly recommended in eryſipelatous caſes; but I obſerve here, that the ſpirit of wine muſt be ſuppreſſed in the beginning of the inflammations, as it increaſes them inſtead of diſpelling the diſorder. The principal aim for removing them, is to avoid all kinds of heat in the parts, and relax the whole to a certain degree.

No. XXXI.

POMMATUM DETERSIVUM.

R. Adeps vipera,	
Tutia preparat. ana	ʒ j.
Albus precipit.	℈ ij.
Miſce ut fiat pommatum, dein adde balſ. commend.	Gutt. xij.

This pommatum is a powerful deterſive in inflammations of the conjunctiva; that is to ſay, when the blood veſſels, which ramificate this membrane, are too dilated and conſequently filled. Its doſe is a grain introduced under the eye-lid.

No. XXXII.

POMMATUM DETERSIVUM.

R.	Axunguiæ Suillæ non Salitæ	ʒ ij.
	Bolus armen. Rub.	
	Tutia preparat.	
	Albus precipit. ana	℈ j.
	Miſce ut fiat pomm. S. A; dein add.	
	balſ. commendato.	℈ j.

This pommatum does not operate ſo powerfully as the above; its doſe and uſe the ſame.

No. XXXIII.

FLUIDUS ELECTRI VIM HABENS.

R.	Balſ. Fioraventi,	ʒ iv.
	Aq. Colog.	
	Meliſſ. ana	ʒ j.
	Lucis,	ʒ ij.
	Spirit. Vol. aromat. oleoſ.	ʒ ij.
	Oleum cinnamo.	Gutt. vj.
	Oleum myrrh.	Gutt. xij.
	Miſce & in flaguncula pone.	

This

This fluid is excellent to promote circulation in the humors of the globe of the eye, and ſtrengthen, at the ſame time, all its exterior membranes. Its uſe is to fetch up through the noſe, by means of reſpiration, the volatile parts of this fluid, and avoid, as much as poſſible, its evaporation out of the bottle during the operation, which may be repeated ſix times; then the patient wets the palm of his hands, and preſents them to his eyes, in order the evaporation be effected over the globe of the eye. When the volatile parts of the fluid are out, two other drachms of aqua lucis ought to be entered into the bottle, to avoid a recompoſition of the whole.

No. XXXIV.

PILULÆ ANTI-SYPHILES.

R.	Mercur. ſublim. corroſiv.	ʒ ſs.
	dulcis,	ʒ j ſs.
	Tere & Miſce; dein adde	
	Gummi Ammoniacum,	
	Guayacum. ana	ʒ j.
	Pul. Sennæ,	
	Pyreth. ana	ʒ ij.
	M. cum S. Q. Syrup. de rhamo ca-	
	tharico F. maſſa. Pilulæ ſunt	*Gr.* vj.

Theſe pills are recommended by the moſt famous phyſicians, in all inveterate and deſperate venereal caſes; they are only uſed when the conſtitution of the patient baffles all other methods, or when an infinity of mercurial remedies have been applied without order. But I muſt obſerve, after many others, that they are ſometimes productive

productive of bad consequences, when used in common. Their dose is three pills taken every morning, and three before bed-time; a number that ought to be diminished according to circumstances. They may be continued for nine or ten days.

No. XXXV.

ANIMATED DIGESTIVE.

Take two ounces of turpentine, beat it well with an ounce of brandy; when it is mixed, add half an ounce of ointment of storax, the yolk of two eggs, an ounce of oil of St. John's wort, two drachms of aloes in powder, and as much myrrh.

A SHORT

A

SHORT PLAN

TO

STUDY PHYSIC AND SURGERY;

WITH THEIR

COMPARATIVE STATE

BETWEEN

FRANCE AND GREAT BRITAIN.

A SHORT PLAN TO STUDY PHYSIC AND SURGERY; WITH THEIR COMPARATIVE STATE, BETWEEN FRANCE AND GREAT BRITAIN.

THE healing ſcience is vaſt. It is divided into two branches, Phyſic and Surgery; but the ſtudy of both is indiviſible. The great number and difference of the parts which compoſe the human body,—the multiplicity of cauſes that may alter them,—and the variety of means which ought to be employed to remedy all the diſorders that theſe cauſes may produce,—require ſo much knowledge for the perfection of this *ſcience*, that the life of man is hardly ſufficient for the moſt extenſive genius to poſſeſs them all, in purſuing the ordinary method generally practiſed in Great Britain. This duly conſidered, I have thought proper to offer a Plan for the ſtudy of that ſcience, more conducive towards its real acquiſition, and in a ſhorter time than is uſually employed. It will ſeem needleſs, conſidering the im-

poſſibility

possibility to reform the abuses of education, and an old established custom of teaching; but, when the reader understands that my advice extends only to the pursuits of the different branches separately, *in statu quo*, he will think otherwise.

The study of Physic and Surgery should be preceded by that of the Mathematics and the Languages. These points obtained, I recommend as absolutely necessary Parkinson's System of Mechanics. The human body is an animated machine,—a knowledge of this science will help very much the student to conceive the motions executed by it, when well regulated, and those which are the effects of its changes. The study of Anatomy ought to be the next pursuit. Previous to entering in a Class of Anatomy, Physiology, and Surgery, as it is taught in Great Britain, it will be of use to consult Albinus's large Anatomical Tables of the Human Skeleton, Muscles, Blood-Vessels, and Nerves. Then a sight of the human bones, their eminences, cavities, foramens, and connections will become so familiar, that the progress, assisted by simple explanations from a friend or private teacher, shall be astonishingly rapid. The muscles, blood-vessels, and nerves, ought to be learned or studied in the same manner.

After a cursory study, and view of these parts of the human body, it will be proper to read the System of Anatomy compiled by Mr Fyffe, from Winslow, Monro, Innes, Hewson, and the living authors. This work is the best on Anatomy in the English language. It contains three volumes *octavo*, including comparative Anatomy. The Anatomy of the Absorbing Vessels of the Human Body, by William Cruickshank, ought to become the next serious study. This work contains more clear principles of physiology and pathology than all the other medical works put together.

When

When the ſtudent has gone ſo far in his private ſtudy, he is capable to benefit in an Anatomical Claſs, to which I adviſe him to enter, and particularly to ſhut his ears to every thing elſe but deſcriptive Anatomy, the profeſſors, in general, being extremely fond to begin by phyſiological explanations, or mix them with anatomical deſcriptions. Such an irregular plan perplexes and confuſes the memory, on the ill-grounded notion, that anatomy, by itſelf, becomes too inſipid and difficult. He ought only to take notice of deſcriptive oſteology, myology, ſplanchonology, angeiology, nevrology, and adenology, as the teacher chuſes to order them. Every thing elſe will be more ſolidly and ſhortly learned by reading authors than by attending claſſes.

Phyſiology conſiſts in the knowledge of the different elements which conſtitute the human body: It teaches the formation of the parts, their connections, and, at the ſame time, explains their functions. The ſtudent who is converſant in anatomy, will make more progreſs in reading than in hearing at the claſſes of phyſiology. Here I am ſorry to inform my readers, that we have no work on phyſiology which I would wiſh to recommend as a ſure and ſhort guide towards this part of the ſcience; but till ſome author preſumes to favour the medical world with one conſiſtent with the abſorbing veſſels, their valves, the new diſcoveries of anatomy, and the pathology of the human body, the peruſal of Haller's Firſt Lines of Phyſiology will ſupply his wants, in ſome degree, together with the medical works below recommended.

Therapeutics inſtruct in the knowledge of the general rules, and means which ought to be obſerved and employed in the cure of diſorders. This part of the ſcience is ſcattered in phyſical and chirurgical works, and ſo nearly connected with the other branches, that it becomes

comes difficult to indicate what author would ſooner aſſiſt than another; for which reaſon, I think proper to recommend Dr George Fordyce's elements of the practice of phyſic as the firſt ſtep in pathological informations. Gaubius's inſtitutes of medicinal pathology will convey an idea of the ſubject, but I muſt acknowledge the work inferior to expectation.

Le Dran and Sharpe's treatiſes on the operations of ſurgery; Pott's chirurgical works; Le Dran's obſervations and conſultations in ſurgery; Broomfield, Warner, Whytt, Gooche's caſes, ought to be ſtudied with great attention, in the order mentioned. The medical obſervations and enquiries by a Society of Phyſicians in London; the London Medical Tranſactions; the London Medical Journal, are works which ought to be the property of medical and chirurgical practitioners, as they contain caſes which may be depended upon. This purſuit will take up one twelve month to an active young man.

The ſtudent being ſuppoſed to have properly acquired ſo much of the ſcience, it will be time to attend one courſe of chirurgical operations, by a practical ſurgeon only. Next to it, a courſe of practical midwifery, during which I recommend to him the ſtudy of Smellie's treatiſe on the theory and practice of midwifery, to which is added, his ſet of anatomical tables, exhibiting the various caſes that occur in practice, by Thomas Young. The two laſt courſes that I would propoſe to the ſtudent, are chemiſtry and botany; during the firſt, he is to peruſe Macquer's Dictionary of Chemiſtry, as a great help in ſuch a complicated ſtudy, and during the laſt *Linnæi philoſophia botanica, cum figuris.* I think it highly improper to learn many branches, and attend ſeveral courſes at once; ſuch a method, although encouraged by ſaving, will produce and multiply blockheads, and diſgrace phyſic or ſurgery.

Having

Having gone ſo far in purſuit of medical and chirurgical ſcience, the ſtudent will be able to determine within his own mind, whether he is fit for the practice of ſurgery or not. This part of the ſcience requires bodily qualities, which are not neceſſary for the practice of phyſic, *viz.* genius, keen ſight, firmneſs of mind, and above all dexterity. The two firſt of theſe qualities depend on nature, and the two laſt will improve with ſtudy and practice. Beſides theſe qualifications, it is neceſſary to poſſeſs humanity and ſympathy; for, in the practice of ſurgery, one ought to ſpare pains to the patient as much as poſſible; however, it would be dangerous to have too much feelings, this might diſturb during operations, but the firmneſs of mind, already required, knows how to check them.

If the ſtudent thinks that nature has qualified him for the practice of ſurgery, he ought to embrace that part of the healing ſcience as the moſt noble and moſt uſeful; if, on the contrary, his bodily faculties forbid him to fulfil ſuch an arduous taſk, he ought to decline it in due time. I firmly and ardently wiſh that all practical ſurgeons may be informed of whatever the practical phyſicians can poſſibly be acquainted with, and when that ſhall take place, the dignity of ſurgeon will be conſidered above that of Phyſician, as it ſhould be.

The reader may be aſtoniſhed at my ſilence concerning the viſiting of hoſpitals. This, in my opinion, ought to be the ſtudent's laſt purſuit. All hoſpitals do not offer the ſame opportunity of real information; there is conſequently a choice, and this may be determined by the ſucceſs of the practitioner at the head of them. We daily obſerve, that phyſicians and ſurgeons bring ſuch charitable houſes in repute, and theſe but too often make the practitioner's reputation. It was once aſked in St.Bartholomew's hoſpital, London; What difference is there

there between Pott and Crane? a humorist answered; The first makes the house, and the house makes the second!—Might not this sarcasm be applied to many?

Considering the state and variation in hospitals, I leave it as the student's business to enquire where is the most extensive hospital, attended by the best practical surgeon, and consider whether his fortune will allow him to go and learn under him. He who intends to practise physic, will not meet with the same difficulty; for if we compare the state of the first practical surgeons with that of physicians, we shall certainly find that the last are fifty to one. Before I draw a parallel of the state of physic and surgery between France and Great Britain, in indicating where are the most numerous and best attended hospitals for proper instruction, it will not be unacceptable to my readers, to take a view of the method of studying it in France.

In Paris, the metropolis of France, there are two colleges, one for the study of Physic, and the other for that of Surgery. All the members of the Royal College of Physicians take the title of Professors, because each in turn delivers lectures in Latin on Anatomy, Physiology, Hygiena, and Therapeutics, separately, and without fee. The members of the Royal College of Surgery are all members of the Royal Academy of Surgery, but these do not deliver lectures by turns, as the Physicians do in their college. The King appoints permanent Professors on Osteology, Sarcology, Physiology, Hygiena, Therapeutics, Operations, Midwifery, and Diseases of the Eye, who deliver separately their lectures in French, at the theatres of the Surgery School, free of all expences. These Professors take the title of *Royal*, because the King allows each of them a salary. Besides these Professors, there are several others appointed by the King, with a salary, to deliver lectures on Anatomy, Physiology,

logy, Surgery, Chemiſtry, and Botany, at the Royal Garden of Plants. Theſe alſo have no fees from ſtudents.

Such ſtudents as wiſh to attend the different courſes, previouſly enter their names (the Swiſs of the College indicates who keeps the book) elſe they could not obtain certificates of attendance. It is cuſtomary before, and at the end of each lecture, to call the names of the ſtudents; if abſent at the time of calling, the profeſſor marks the abſentees a certain number of times, and, when they call for their certificates of attendance, they are either refuſed, or granted as their name ſtands marked. There are likewiſe private profeſſors who teach ſeparately or jointly all theſe branches of the ſcience for a moderate fee; they grant certificates of attendance, but if theſe private profeſſors are not members of the Royal College of Phyſicians or Surgeons, their certificates muſt be alſo ſigned by a member of either College, as a ſanction that they are able to teach properly, or they would be of no manner of uſe. Monſieur Deſſaulx's certificates were ſigned by him and Monſieur Louis, before he was admitted member of the Royal College of Surgery.

The only public ſchool not free to every ſtudent is, *L'école pratique*. It is generally compoſed of ſuch as have been remarked to be attentive and induſtrious in the courſes. A place in that ſchool is not eaſily obtained. Thoſe who offer themſelves candidates for it undergo ſeveral cloſe examinations, and when found capable, they muſt be recommended by ſome members to be of good morals. Here they have a great advantage over the other ſtudents, which is that of practice under the direction of the greateſt maſters in the ſchool, who are all profeſſors, and repeat the courſes with more preciſion, attended with all the *minutiæ*. Every year, gold and ſilver medals are diſtributed among ſuch of the ſtudents as produce the beſt paper, the beſt injection, and diſſection,

diffection, or the beft anfwer to a difficult queftion propofed by the profeffors, who fupport and attend the fchool.

With thefe advantages, known throughout Europe, Paris has the advantage over every Univerfity in the world for medical and chirurgical information. The Courts of Europe, at their refpective expences, fend ftudents to Paris on purpofe to ftudy and practife furgery. Every year Ruffia fends fix, Vienna four, Holland four, Drefden two, Rome four, Denmark two, Berlin four, Poland two, Sardinia four, Spain eight. Thefe are prefented by the ambaffadors of their Court, and maintained in Paris during the time of their ftudies.

When a young man has a mind to learn furgery, and cannot afford to maintain himfelf during his ftudies, he learns to drefs hair and fhave, then he enters in a barber's fhop, under the title of *Major*, in which capacity he receives, for the work of the fhop, five fhillings *per* month, befides his board and lodging, and obtains leave twice a week, during the courfes, to attend the public lectures above mentioned and the hofpitals. When he has attended each courfe, he obtains certificates of attendance, and retires into the country to practife; fo that a young man, deftitute of fupport, acquires as much of the fcience in five years, as another might in one year for feven or eight hundred livres, which is about L. 30 Sterling. There are innumerable inftances of thefe *majors* becoming very great Surgeons; and one particularly is at prefent firft furgeon to the king. Monfieur de la Martiniere is faid to have put a check to that kind of education; but whenever the *majors* enter their name, they take lodgings at a private houfe, which they indicate as a guarantee, that they do not follow the fhop bufinefs. They particularly take care to drefs genteely to avoid

avoid ſuſpicion at lectures; and, on returning to the ſhop's work, they put on *l'habit de poudre*.

After ſtudents have received their education, the manner of granting *diplomas*, and becoming members of the colleges, will not be unwelcome to my readers. The college of phyſicians requires of the candidate, his extract of baptiſm, his diploma of *magiſter artium en l'univerſité des quatre nations*, his certificates of lectures; and, on paying about 600 livres of different fees, the firſt *theſis* is admitted, and a day appointed to determine on its merit, and that of the author. If the candidate is 24 years of age and one day, a Roman Catholic, provided with the above diploma and certificates, and found capable by his *theſis*, leave is granted to bring on the next month his ſecond, ſupported with fees as the firſt, and ſo on, till he has gone through 15 *theſis*, and paid about 5000 livres. Then a diploma is given him, which entitles him to practiſe in Paris, or any place in the kingdom. If the fortune of the candidate ſhould not allow him to pay all theſe fees, in courſe of every month appointed for each *theſis*, leave is granted to bring in the ſecond, when it may ſuit his pocket, which may be protracted one year or more; and, after his firſt *theſis*, he is allowed to practiſe as candidate, provided he promiſes to ſupport 14 more with the ſame fees at each.

The college of ſurgery, and the Royal Academy of ſurgery, are very different from each other. The college of ſurgery is juſt as expenſive in its fees to the candidates as that of phyſic; but no member can belong to both at the ſame time, it being even required of a candidate to free himſelf of any other body, previous to be admitted a candidate to either; for example, *un maitre en chirurgie de Paris* cannot be *maitre en chirurgie* of any other college in the kingdom, but he may belong to a college of phyſic, except that of Paris. *Les docteurs*

en medecine du college de Paris obſerve the ſame rules. The intention of this plan is, to excite emulation, and keep one another in countenance.

The exorbitant fees of the College of Phyſic and Surgery in Paris has particularly divided the practice of Surgery into two branches; *la petite et la grande chirurgie*. The practice of phyſic being indiviſible, has ſuffered no material change. The College of Surgery grants 100 places, which are almoſt unconnected with it. Such ſurgeons as obtain them, are called *chirurgiens privilegiés*. Before they are entitled to practiſe, they undergo an examination by the Royal Profeſſors of the College, who either refuſe or admit them. Theſe *chirurgiens privilegiés* practiſe only *la petite chirurgie*, that is to ſay, they cannot perform great operations unleſs one of the members of the college be preſent, or elſe the operator ſtands a chance of loſing his place, or ſeverely fined. It muſt be obſerved, that the Princes of the blood, and people of the firſt rank, have a power to grant a place of ſurgeon, who takes the title of the donor. They can only practiſe *la petite chirurgie*, except the ſurgeon of the Princes of the blood; but in general, they are members of the College of Surgery; for the public have little or no opinion of all the others.

Monſieur Petit, belonging to neither of theſe Colleges, made a great puſh to oblige them to admit candidates without fees, provided that ſuch as would offer themſelves upon that plan, ſhould be examined *ex tempore* by the Profeſſors, and, as an inſtance, preſented himſelf to the College of Surgery. The College informed of his intention, refuſed to admit him a candidate on that ſcore, of courſe it was dropt on both ſides. Sometime after, Monſieur Petit offered himſelf a candidate to the College of Phyſicians, on the ſame terms as he had formerly done to the College of Surgery; theſe, leſs actuated

ated by intereſt, embraced the opportunity of incorporating in their body a man of reputed abilities, both in the medical and chirurgical line.

Much about that time, there was a conteſt between the two Colleges, which conſiſted in aſcertaining who ſhould have the precedence in point of ſuperiority of rank at Court, and whether Surgeons ſhould be allowed to practiſe Phyſic, and Phyſicians Surgery. After a long proceſs at law, the King's firſt Phyſician and firſt Surgeon ſettled amicably the diſpute in the following manner: Phyſicians ſhould be allowed to practiſe Surgery, and Surgeons to practiſe Phyſic, under the reſtriction, that the latter ſhould not ſign their *recipe*, and that four phyſicians ſhould be preſent at the reception of a candidate in ſurgery, and that no ſurgeon ſhould be required at that of a phyſician. Thus ended a diſpute, on the conceſſion of the ſurgeons, and began a rivalſhip, which has induced, and ſtill induces, both bodies to ſurpaſs each other, in a ſcience ſo uſeful to humanity. From the emulation of theſe two bodies, who continually ſtruggle which ſhall be more deſerving of public eſteem, the ſcience has made rapid and conſiderable progreſs.

The hoſpitals that are free to every viſitor are not, however, free for practice to every phyſician and ſurgeon; they are each attended by a Chief Surgeon, with a ſalary, and Phyſicians without ſalaries. The firſt is aſſiſted by two, three, or more Aſſiſtant-Surgeons, without ſalary, according to the ſize of the hoſpital. In the Hotel-dieu there are four Aſſiſtant-Surgeons for a certain time, deputed by the College of Surgery, after which they become free of the buſineſs of the hoſpital, and are afterwards admitted members of the College of Surgery, without paying fees. They are called *Chirurgiens gagnant maitriſe*, and, in general, ſerve three years. Theſe aſſiſtants can do nothing without the conſent of

the principal ſurgeon, who may indeed call a conſultation; but, when it happens, it may be looked upon as a condeſcenſion on his part.

It has been particularly a reproach to the Hotel-dieu of Paris, that the method of crouding ſeveral patients in one bed, was abſurd and diſgraceful to humanity. I think it will not be improper to clear the adminiſtration of that houſe of ſuch an ill-grounded charge. It ſhould be underſtood, that there is neceſſity for a political conduct in the management of the largeſt hoſpital in the world; which is to diſguſt the public's eye, in order to keep away as many as poſſible, without refuſing aſſiſtance to any one. This is exactly the caſe with that houſe; for, whenever there are ſeveral patients in one bed, it is always managed according as the caſes will ſuit. Some people have been found ſtill living among others half-dead, and others entirely deprived of life, all in the ſame bed; but it has never been obſerved, that a patient was ſo mixt, when there was the leaſt chance; therefore, every objection, above mentioned, ought to appear trifling to a man who knows how liberally that hoſpital extends its charity.

There are in Paris ſix large hoſpitals, the ſmalleſt of which is conſiderably bigger than the largeſt in London. Theſe houſes are open to every medical ſtudent, free of expence, and each has a particular hour for dreſſing patients; ſo that a young man who ſhould be active and diligent, might, in Paris, be employed in dreſſing from ſix in the morning till ſix at night, without it ſhould be neceſſary for that to be reſiding in either of theſe hoſpitals. In every hoſpital there is a permanent Principal Surgeon, the *Gagnans Maitriſes*, and the Dreſſers. If a ſtudent be obſerved to attend cloſe as a looker-on, the firſt ſurgeon, or the firſt dreſſer, commonly takes notice of him, and, on his aſking the *tablier* of the principal

ſurgeon,

ſurgeon, it will chearfully be granted him. I muſt obſerve here, that certificates of attendance in hoſpitals as dreſſers, are abſoutely required to become candidates for, or obtain places in the Army and Navy, or even to buy *un privilege pour exercer la Chirurgie dans Paris*.

Many of the principal towns of France have alſo colleges of phyſic and ſurgery upon the ſame plan as thoſe of Paris. Montpellier, Rheims, Toulouſe, Rouen, Angers, Orleans, Lyon, Nancy, Dijon, are places where a ſtudent may live remarkably cheaper than in Paris. When all theſe opportunities are conſidered, together with the freedom of the public libraries, without the expence of a ſingle farthing, it will be no difficult taſk to account for the progreſs of phyſic and ſurgery in France. In Paris, *la biblioteque du Roy* is open twice a week to every body. There the reader will meet with all the writers of Europe in their reſpective languages, and that without the ſmalleſt objection and the leaſt trouble. *La biblioteque de St. Germains* is open every day, morning and evening, except Saturday evening. There are likewiſe ſeveral public libraries, that any body will ſoon know on the firſt enquiry of any of the viſitors, who generally are the poor *literati*.

It is needleſs to inform the reader of the method purſued in Great Britain to learn the ſcience, and obtain diplomas to practiſe it; the ſtudent being made acqainted which Univerſities and Hoſpitals will moſt probably turn to his advantage will be quite ſufficient, if he adopts the plan above mentioned. London, the metropolis of England, has no univerſity; but on account of ſeveral reputed teachers of anatomy, and the largeſt hoſpitals permanently attended by the beſt practical ſurgeons, it is become the moſt eligible place for general information both in the medical and chirurgical line: *Mais tout ſe fait à force d'argent, l'humanité y eſt comptée pour peu de choſe,*

chose, la preuve de cette assertion se trouve dans la conduite de tout le monde ; chacun commence par demander : combien me coutera cela ? combien me donneres vous ? In London charity extends beyond the imagination, and those employed to administer it, are wholly taken up and actuated either by their own interest or that of their friends. If a student enters as a dresser at St. Bartholomew's Hospital, he must pay 50 l. Sterling for his ticket of admission during a year; if only for six months, he pays 25 l. or else he cannot walk the Hospital as a looker on. Such a practice, in Royal Hospitals, however supported by reasons, is a disgrace to government, and the practitioners themselves ; to the first, because what belongs to government belongs to the public ; to the second, as they often act in a parsimonious manner, they are sheltered from public censure.

Edinburgh, the principal city of Scotland, has an University and a Royal Infirmary. Many abuses in the first might be shown ; but considering that it would produce no alteration, I shall confine myself about the management of the Royal Infirmary, as the most essential part of the student's education. This charitable house is poor, has no permanent surgeon, and being attended by the members of the Royal College of Surgery in turn, it will be for ever a scene of unaccountable trials at the expence of humanity, the discredit of the chirurgical practitioners, and perplexing to students. Many instances might be brought to prove this assertion beyond a doubt, and I must confess that it cannot be otherwise. There should be a principal surgeon with a salary, and four assistants, who should serve each three years at least, before they could be admitted members of the Royal College of Surgery, and the Hospital free to every student at any time, except when a physician or surgeon delivers clinical lectures.

Dublin

Dublin, the metropolis of Ireland, is extremely deficient in point of medical and chirurgical education. It is worse still as a place of information, having neither hospitals nor teachers who have deserved a public fame. Trinity College, Cambridge, Oxford, Glasgow, Aberdeen, St. Andrews, all grant diplomas!

There is a kind of imposition every day laid on the student, which he ought to be informed of; I mean, compilations in the medical and chirurgical line. We have but too often observed that writers publish with two views, the first to be known, and the second to get money by it. The authors I have mentioned, may have wrote also from interest; but as they convey information, it will make amends for the purchase of their works. We are daily smothered with new works, which in fact are old books. Read Baglivi, Boerhaave, and Haller, you will find nothing new in Cullen's works. Read Storck on hemlock, and put it in practice, you shall undoubtedly be convinced, that it has committed more murders since its publication, than all the armies of the late King of Prussia, &c. &c.

When two Doctors of Physic differ in points of practice, the student may safely conclude, that they are both in the wrong. This axiom may properly be extended to the dispute between Doctors Brown and Cullen, and yet the last needs only say one word at lectures; an army of Doctors Brown will be like the straw before the wind, it being extremely difficult to overthrow *fame* of whatever nature she may be.

After what has been said concerning the education and the practice of Physic and Surgery, both by Colleges and Hospitals in France and Great Britain, it will be the student's interest to learn the French language, particularly if he has a mind to become a practical Surgeon.—On one side, he knows that the French government opens Colleges,

Colleges, and pays learned Profeſſors to teach and practiſe, free of expences, before who has a mind to learn ; on the other, he is informed that the education of one of the moſt complicated ſcience in human life is left in the hands of intereſted, and too often ignorant Profeſſors. On theſe conſiderations and informations, he is now enabled to benefit by the above intelligence.

From that ſource of liberality in the French government, the progreſs of the ſcience muſt have been rapid and conſpicuous to every one, without it be poſſible to bring a decent compariſon between the two kingdoms. Phyſic and Surgery are two ſciences very near connected ; the ſtudy of both is hard and diſguſting at firſt, but when either advanced or underſtood, the moſt pleaſing and moſt neceſſary to a rational being.

EXPLICATIO

EXPLICATIO FIGURARUM.

Tab. I.

NERVI BULBI & MUSCULORUM OCULI.

A.	Bulbus oculi.
B.	Glandula lacrymalis.
C.	Muſculus abducens.
D.	Muſculus attollens.
E.	Levator palpebræ.
F.	Muſculus deprimens.
G.	Muſculus adducens.
H.	Obliquus ſuperior.
I.	Trochlea.
K.	Pars muſculi obliqui inferioris.
L.	Carotidis decurſus in receptaculo.
M.	Carotis in cavitatem cranii penetrans.
N.	Arteria ophthalmica ex carotide orta.
a.	Nervus opticus foramen ſuum tranſiens.
b.	Nervus quinti paris in cavitate cranii.
c.	Nervi quinti paris ramus tertius.
d.	Ejuſdem ramus ſecundus.
e.	Ramus primus.

f. Primi rami *e.* ramus frontalis in duos ramos iterum divifus.

g. Primi rami *e.* ramus nafalis.

h h. Rami *g.* ramuli ciliares fuper nervum incedentes.

i. Rami *e.* ramus lacrymalis.

k. Nervus quarti paris.

l. Nervus fexti paris duplex in receptaculo.

m. Radix duplex nervi intercoftalis a fexto pari.

n. Sexti paris infertio in mufculum abducentem.

o. Truncus nervi tertii paris.

p. Tertii paris ramus fuperior, minor.

q. Rami *p.* ramuli ad attollentem mufculum.

r. Rami *p.* ramulus ad levatorem palpebræ.

s. Tertii paris ramus inferior major.

t. Rami *s.* ramus ad mufculum adducentem.

u. Rami *s.* ramus ad mufculum deprimentem.

x. Rami *s.* ramus ad obliquum inferiorem.

y. Ganglion ophthalmicum, nexu cum nervo optico folutum, & ad exteriora revolutum, ut divifio nervi paris tertii pateat.

z. Radix brevior ganglii ophthalmici, a nervo obliqui inferioris.

1. Ganglii radix longior a ramo nafali quinti paris.

2. Nervorum ciliarium fafciculus fuperior, quem quatuor hic nervuli faciunt.

3. Fafciculus inferior.

4. Fafciculi inferioris ramulus extrorfum a reliquis fecedens.

5. Ramulus alterutri furculo *h. h.* ex nervo nafali orto infertus, ad latus externum nervi optici infra fafciculum fuperiorem adfcendens.

Fafciculi

6. Fasciculi inferioris nervus ciliaris inferior interior.

Tab. II.

Arteriæ & venæ oculi: *Vide* pag. 25.

a b c Arteriolas ciliares longas ad venæ vorticosæ iridis abeuntes.
d e Arteriæ ciliares breves ad venæ vorticosæ choroides abeuntes.
f Nervus opticus.
g Insertio arteria centralis in nervo optico.
hiklm nop Insertio arteriolæ visuales in nervo optico.
q Sclerotica.
r Cornea.

Tab. III. *Vide* pag. 49.

Tab. IV. *Vide* pag. 240.

Fig. 1.

Demonstrat hæc figuræ integrum tympanum cum ossicula & labyrinthum cum cotunnii aqueductibus auris humanæ internæ.

Fig. 2.

Representat partem ossis petrosi sinistri hominis adulti, a quo vestibulum, & canales ablati sunt, solus vero gyrus cochleæ primus patefactus est relictus, & a parte an-

teriori ita derasum est os, ut progressus aquæductus cochleæ, et venæ vestibuli apertissime conspiciatur.

a a Gyrus cochleæ primus per longitudinem patefactus.
b b Aquæductus cochleæ per totam sui longitudinem apertus.
c Semicanalis osseus inferiori aquæ-ductus orificio continuus, pariter in longitudinem divisus.
d d Decursus venæ cochleæ.
e Locus in quo intra semicanalem terminat canalis osseus venam ducens.
f Orificium aquæductus cochleæ superius vicinissimum insertioni venæ.
g Rami duo venæ cochleæ, qui a trunco emergunt, et per primum cochleæ gyrum incipiunt progredi.
h Ramus alter ejusdem venæ ad vestibulum pertinens.

Fig. 3.

Ostendit apicem cochleæ dextræ, qualis apparet cupula detracta, ut infundibulum, gyri albi laminæ spiralis rostrum, terminus et rostrum zonæ cochleæ naturali in positu conspicerentur. Actus autem ad decuplum vitro, pictus est.

a a Semigyrus ultimus cochleæ.
b Extremitas secundi gyri.
c Centrum infundibuli, sive orificium tubi, circa quem secundi cochleæ gyri postrema medietas, et ultimus semigyrus sunt declives.
d Margo liber, in quo desinit ultimus semigyrus.
e Rostrum gyri albi laminæ spinalis in quo.

Margo

f Margo concavus,
g Margo convexus,
h Apex.
i Zonæ cochleæ ſumma pars.
k Locus in quo anguſtatur ſecuta ductum roſtri laminæ ſpiralis.
l l Margo apicis zonæ convexus, qui infundibuli pavimento eſt alligatus.
m, m Margo ejuſdem concavus, qui convexo margini roſtri gyri albi laminæ ſpiralis alligatur.
n n Apex zonæ, qui in roſtri formam tandem deſinit.
o o Vaſcula, quæ a foramine axem modioli occupante penetrant, et per fundum infundibuli diſperguntur.
* Seta per foramen triangulare, ſub roſtrum gyri albi laminæ ſpiralis poſitum a ſcala veſtibuli in tympani ſcalam intruſa, et viam oſtendit, per quam ſcalæ communicant.

Tab. V.

Oſtendit hæc figura violina harmonica. *Vide* pag. 256.

F I N I S.